

Aquilegia

Magazine of the Colorado Native Plant Society

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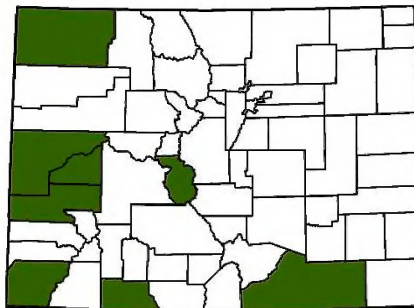
Sequential photographs showing visitation and pollen transfer by a syrphid fly (June 2008). © Denise Wilson

Stream orchid, *Epipactis gigantea*

(Orchidaceae). An uncommon orchid in Colorado, it is found in wet areas, including hanging gardens, marshes (particularly near hot springs), meadows, and in life zones ranging from desert to montane. The plants range in height from 30 cm up to one meter. Flower size is 2-5 cm in width. As found in other orchids, pollen is held in a structure called a pollinarium, comprised of a pollinium (coherent mass of pollen) and a viscidium (sticky tissue). This entire structure adheres to insects for transfer to another flower. Several different insects may be involved in *E. gigantea* pollination. In particular, syrphid flies have been documented as common visitors. One source of attraction for the flies are aphids, or the appearance of aphids due to mimetic morphology of the orchid's lower lip. KA

See page 8 for a research report on *E. gigantea* by Denise Wilson and Rea Orthner.

Cover photo © Scotty Smith.



Map adapted from Ackerfield, *J. Flora of Colorado*. 2015.

Botanicum absurdum by Rob Pudim



© Rob Pudim

Aquilegia Observes Plant Names per *Flora of Colorado*

Just as this publication has a style sheet to help maintain some level of consistency in formatting and editorial style from issue to issue, *Aquilegia* also adheres to the botanical Latin plant names used in *Flora of Colorado* (2015) by Jennifer Ackerfield.

While common names might vary from region to region, binomial Latin names provide a common starting point to guide a conversation about a particular native plant. *Flora of Colorado* provides the most current Angiosperm Phylogeny Group III system standards, sorting taxa into the most recent family frameworks.

Readers may also want to familiarize themselves with other guides such as *Colorado Flora, Eastern and Western Editions*, by William A. Weber and Ronald C. Wittmann (2012), as well as The Biota of North America Program online guide to North American Vascular Flora (<http://www.bonap.org/>), and other resources.

Aquilegia: Magazine of the Colorado Native Plant Society

Dedicated to furthering the knowledge, appreciation, and conservation of native plants and habitats of Colorado through education, stewardship, and advocacy

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Featured Story

Yes, Virginia, Manzanitas Do Grow Wild in Colorado! The Cultivation of *Arctostaphylos* in Colorado

By Panayoti Kelaidis

It all began around my parents' kitchen table in 1963. My brother-in-law and plant mentor Allan Taylor had just returned from Berkeley, where he had obtained his doctorate to teach at CU Boulder. Although a native Coloradan—from Palisade in the Grand Valley, to boot—he had fallen head over heels in love with California horticulture and was despairing at what to grow in poor, impoverished Colorado. “Heck, we don’t even have manzanitas!” he pronounced.

I pounced: “Yes, we do!”

He stared at me incredulously. Every spring vacation for the last few years I’d gone out to California to visit him, along with my sister and other siblings who’d settled in the Bay Area. Thanks to Allan, I’d learned a lot of botany already and fallen in love with California’s signature native shrub. Later, back in Boulder, I made a point of turning south on 14th Street on my way to school in order to walk by a certain garden, one I considered the most sophisticated and beautiful garden in the state of Colorado.

Stopping to admire it, I could see several species of manzanita clambering down reddish sandstone rock work, much as they do in nature. Allan clearly didn’t believe my pronouncement at the kitchen table, so the next day I had to drag him the two and a half blocks to that miraculous garden and show him. Allan is nothing if not impetuous—as soon as he caught sight of the manzanitas, he scampered up to the front door, rang the doorbell, and initiated a friendship that would alter the course of our lives—and perhaps that of Colorado horticulture.

T. Paul Maslin, the owner of the Boulder garden, deserves the credit for first cultivating *Arctostaphylos patula* (greenleaf manzanita) and *Arctostaphylos x coloradoensis* (Panchito manzanita) in Colorado. At that point, he also had a wide lawn of kinnikinnick (*Arctostaphylos uva-ursi*) on the level area to the left of the path leading up to his front door, so he’d achieved a trifecta of all three taxa that are native to our state. I have written a tribute elsewhere to Dr. Maslin (<http://prairiebreak.blogspot.com/search?q=maslin>), who became my second mentor in horticulture and my best friend the last 15 years of his life. Suffice it to say, he was a world-renowned biologist, his specialty was herpetology, and he was

the first in the United States to discover parthenogenesis in vertebrates.

Although he was curator of biology at the CU herbarium and a popular professor who fostered large numbers of graduate students, he had an abiding passion for gardening that perhaps was inspired by growing up on Lushan, one of the greatest mountain ranges in Central China and a biological hot spot. He practiced the traditional English style of gardening with unusual trees, shrubs, a perennial border, and extensive rock gardens around his home, but both his home and garden had a flair that reflected his East Asian childhood. Paul retired early from his career at CU so he could indulge his love of gardening.

Paul grew all manner of plants in his Boulder garden, but because he had done so much fieldwork all over Colorado and the Southwest, he had a special love of natives and tried to incorporate as many of them as he could into his Boulder garden. When the northeastern quadrant of his garden proved hard to water, he dedicated it to native dryland plants. Still present today at the edge of the property are two large junipers, *Juniperus monosperma* and *Juniperus osteosperma*, planted next to one another so one could compare the growth habits of these two predominately eastern Colorado and Western Slope species, respectively. ►



***Arctostaphylos uva-ursi* (kinnikinnick), Evergreen, CO. © Panayoti Kelaidis**



Panayoti Kelaidis and Paul Maslin on an expedition to Mexico in 1983. © Panayoti Kelaidis

◀ In my twenties, I became Paul's traveling companion and we covered extensive areas of western Colorado, New Mexico, Utah, and finally Mexico in pursuit of the yellow flowered phlox, which Paul published as *Phlox lutea*—another story for another time. But Colorado manzanitas were a focus of much of Paul's obsession: he was convinced these would make an outstanding introduction to horticulture. We undertook a half-dozen field trips to the Uncompahgre Plateau to mark, observe, and take cuttings of manzanitas during the 1970s and early 1980s.

On our initial field trip there around 1974, I saw manzanitas in the wild in Colorado for the first time. I will never forget the surprise of seeing masses of army-green shrubs covering so many different habitats with such breathtaking variety of forms: some almost as small as *A. uva-ursi*, and every permutation between that and the tallest, broad-leaved, *A. patula* forms. At the time, we thought the intermediate forms might be *Arctostaphylos nevadensis*, from California, which they superficially resembled. Since then, most botanists have come to believe they simply represent a cline of hybrids between kinnikinnick and the large species, *A. patula*.

We visited these manzanitas again in 1977, with some concern after the entire state had experienced two years of extraordinary drought. There was so little snowfall one winter that ski areas could hardly open, and the use of snowmaking equipment was initiated. In addition, water restrictions were instituted for the

first time in Denver. We were shocked during our summer visit to find practically every manzanita on the Uncompahgre had turned bright orange. We despaired that the plants would perish due to drought and winter sunscald.

Then came the early 1980s, which saw some of the wettest years I can remember. One late April, we toured the Grand Valley (sometimes called "the stinking desert" due to the smell of selenium), which looked like an overplanted English flower garden. There were masses of color right up to the road verges and thousands of *Calochortus nuttallii* blooming in the road medians where no one had ever seen them before. Later that summer, we returned to the heights of the Uncompahgre Plateau. To our surprise, the manzanitas were green and healthy, and we could see no sign of any necrosis anywhere: they had bounced back completely!

We took one last field trip to the Uncompahgre in 1981 to gather cuttings to propagate at the Denver Botanic Gardens. We went early enough in the season to see the manzanita in bloom (spring cuttings often strike well) and selected some with dark pink flowers, others with dense habit, and some large species. The propagation staff at DBG rooted dozens of cuttings. ▶



***Arctostaphylos patula* (greenleaf manzanita, top) and *Arctostaphylos x coloradoensis* (Panchito manzanita, bottom), both at the Dryland Mesa in the Denver Botanic Gardens. © Panayoti Kelaidis**

◀ These were grown on and planted out on several garden areas: the Rock Alpine Garden, the Hildreth Garden (now the South African Plaza and conifer berm) and especially along the east face of Dryland Mesa (which was originally called the Xeriscape Garden).

Interestingly, the plants in the Rock Alpine Garden and Hildreth Garden did not persist; both areas had extensive irrigation systems whereas the Dryland Mesa was never watered—and that is where the manzanitas still flourish! The plants matured to form dramatic stands that attracted a great deal of interest among keen gardeners in the region, notably Dermot Downs and Betsy Baldwin-Owens, who ultimately made their own expeditions to western Colorado. The Downs/Baldwin-Owens introductions are ultimately the ones that have had the widest distribution in cultivation through the Plant Select program (which I will describe in a subsequent article).

The Colorado nursery industry at the time wasn't quite ready for these plants, so Paul shared propagules with Siskiyou Rare Plant Nursery in southern Oregon, which offered Paul's introductions for many years. He even tried to interest Royal Botanic Gardens, Kew, in them, but not much came of that. When I started my career at Denver Botanic Gardens in April 1980, Paul decided that that would be the perfect time to showcase the genus where everyone could see them.

However, there are several other early efforts that deserve to be mentioned in this article. While Paul and I were exploring the Uncompahgre, a budding nursery in Salt Lake City decided to specialize in producing native plants from the Intermountain region for revegetation. That nursery, Native Plants, operated for nearly two decades, offering an amazing variety of native shrubs, trees, and perennials to regional garden centers, including selections of an *Arctostaphylos* hybrid (of the *x coloradoensis* complex) collected in Utah that they named "Santi." This was distributed by Native Plants, and I have no doubt that "Santi" persists in private gardens today. The company was so successful that it expanded to operations around the U.S., and even undertook projects in Saudi Arabia. The expansion ultimately led to a collapse, and key staff of this first major wholesale nursery marketing Rocky Mountain native plants went on to found Progressive Plants, also in the Salt Lake City area. Progressive Plants is still in operation selling manzanitas, only now they offer the Plant Select varieties.

Another short-lived native-plant nursery was founded in the 1970s by Charles Weddle, a plant breeder from Texas who settled in Paonia and finally in Palisade. I remember seeing an inset of Weddle on the front page of Park's seed catalogs when I was a youngster,

not realizing that one day we would meet and become friends. Weddle co-founded PanAmerican Seed, a company which revolutionized the annual seed industry and pioneered the breeding of many popular strains of annuals. His long and successful career culminated in his building a complex of greenhouses in Palisade, where he established a native-plant nursery. Many of the plants he first sold came from trays of plants he bought from Native Plants, but Charles also did extensive collecting in the wild. He hired Jim Borland, who experimented with dozens of native taxa—and who should be persuaded to tell this story properly! I purchased manzanitas grown by this nursery that we planted in the Rock Alpine Garden in the early 1980s.

The native-plant nursery, unfortunately, closed when Weddle died. It did, perhaps, pave the way for Chelsea Nursery—Colorado's most extensive native-plant retail and wholesale business operates today in Clifton, a short distance from where Weddle's nursery once stood. I suspect some of the Weddle manzanitas may still be growing in Grand Valley gardens. If so, they are surviving monuments to a great and underappreciated Colorado horticulturist.

Another piece of the continuing manzanita story can be found on the Green Mountain slope in Lakewood, Colorado. Judie and Fred Eidson bought their home there in 1980, and, as keen nature lovers, they decided to focus their garden on native plants. They frequented Western Evergreens and later Larry Schlichenmayer's Old Farm Nursery, the premier nurseries in the Denver area in the early 1980s, both of which grew a variety of native plants. They also went to Weddle Native Gardens in Palisade and met Charlie Weddle and Jim Borland.

From these sources, the Eidsons purchased a number of manzanitas, which have grown superbly in their ►



***Arctostaphylos patula* (greenleaf manzanita) in the Eidsons' yard. © Judie Eidson**

◀ garden since. They also collected several small *A. patula* plants from the Western Slope, one of which has undoubtedly become the most imposing specimen of that species in the state, at nearly six feet tall. It remains tall and strong even after damage caused by the St. Patrick's Day blizzard of 2003. During 2020, Kelly Grummons collected nearly a thousand cuttings off this enormous plant and sent them to a specialty nursery in Oregon for propagation. In a few years, this superb cultivar may be available in the Denver area for purchase. I suspect the Eidson's plant will have a long and glorious future in the landscape industry!

The story of manzanitas in Colorado gardens has perhaps just begun. No other shrub I can think of offers so many outstanding landscape features: beautiful evergreen leaves, showy flowers in late winter and spring, bright berries in the autumn. They form an attractive mound in the landscape and thrive with little or no irrigation. Most have beautiful reddish bark, and they can form sculpturesque specimens as they age.

And thanks to Plant Select, a suite of cultivars is now available for purchase at the better local garden centers. Best of all, the better landscape designers and contractors in the region are beginning to plant manzanitas in public landscapes. Manzanitas growing on median strips in Denver and the suburbs show that this native plant has truly made the big time!

Panayoti Kelaidis joined CoNPS in the second year of its existence and was the second secretary of the society in the early 1980s. He has worked at Denver Botanic Gardens for 41 years and is vice president of the North American Rock Garden Society.

Editor's note

Manzanitas and Wildlife

Evergreen leaves and showy flowers, interesting bark and bright berries, toughness, and ability to survive on little water—*Arctostaphylos* species have a lot to offer to gardeners. As a native Colorado plant, manzanitas also have relationships with insects, birds, and other animals here. *Arctostaphylos uva-ursi* (kinnikinnick), considered a groundcover, provides fruit for chipmunks, bears, and fruit-eating songbirds, including Townsend's solitaires. One plant list shows 14 different bird species, including hummingbirds, benefiting from kinnikinnick! A search using the Native Plant Finder of the National Wildlife Federation revealed that in one ZIP code area alone (which is how the NWF searches for plants), kinnikinnick serves as host plant for 23 species of moths and butterflies, such as the hoary elfin butterfly (*Callophrys polios*).

"Manzanitas..." continued on page 13 ►

The Ethics of Native Plant Collecting

CoNPS has developed guidelines for the ethical collection of native-plant materials (including seeds or flower parts, leaf or stem material, or any other plant part).

As per the guidelines, "The Colorado Native Plant Society encourages the ethical collection and use of Colorado's flora. Lack of commercial availability of many plant species, greater demand for native plants in horticultural settings and the reestablishment of native plants in restoration efforts can require that seed and/or other plant material be prudently collected from plants in their native habitats. Likewise, plant material necessary for study and research purposes must also be collected under ethical guidelines.

"Good land stewardship emphasizes that we recognize the sensitivity of native plants as well as the environments in which they grow. Picking wildflowers or collecting seed may reduce a plant's ability to reproduce and can affect pollinators, adversely impacting the long-term survival of a population. When plants are removed from their natural environment, habitat is reduced for animals that depend on that species for food and cover; further, many species do not survive being transplanted. Likewise, the ecological effects of escaped exotics or misplaced natives can occur either through competitive replacement of native species or through alternation of native plant population genetics.

"CoNPS members who are collecting plants or teaching collecting protocols while representing the Society must first complete the CoNPS training 'Ethics and Protocols of Plant Collecting.' Members can satisfy this requirement by completing any Society-sanctioned training; one such avenue is the training module posted on the Society's webpage."

The text of the entire document can be found at https://conps.org/wp-content/uploads/2017/02/Ethics_of_Collecting_CoNPS_Approved_10-5-2013.pdf

Staff members of the Denver Botanic Gardens conduct plant-collecting expeditions as part of their work. The work is encompassed by the following definition: "A botanical garden or botanic garden is a garden dedicated to the collection, cultivation, preservation and display of a wide range of plants" (https://en.wikipedia.org/wiki/Botanical_garden#cite_note-1). They collect plants with strict adherence to the law and with the express purpose of studying and protecting wild populations of plants.

Research and Reports

***Epipactis gigantea* Population Stable, but Numbers and Growth Tied to Precipitation Patterns**

By Denise C. Wilson and Rea Orthner

CoNPS annually funds grants to support field and laboratory research as part of its John W. Marr and Myrna P. Steinkamp grant programs. Reporting on projects is a requirement of all grant recipients. In this issue, we are pleased to feature the following report. Denise Wilson, is a Steinkamp grant recipient.

The site: Filoha Meadows Nature Preserve

Filoha Meadows Nature Preserve supports thermal bogs with rare plants and insects, including fireflies, plus critical habitat for elk and bighorn-sheep calving. It is owned and managed by Pitkin County Open Space, but access is not permitted to the public. To better manage this delicate ecosystem, Pitkin County Open Space has funded important research work.

The rare plant: *Epipactis gigantea*

Epipactis gigantea (the giant helleborine or stream orchid) is a riparian, sensitive species of the Rocky Mountains and the western United States and Mexico, occurring in great numbers at this site. It is an S1/S2 Colorado state critically imperiled to imperiled plant that is ranked globally secure, G4 (Colorado Natural Heritage Program 2021). The United States Forest Service ranks it as Sensitive, with studies indicating that populations are quite distinct genetically because

they are disjunct, and so every population is essentially unique.

Besides requiring a constant supply of water, it is always restricted to minerotrophic (nutrient-rich) habitats (Brunton 1986), and is further restricted in the Rockies in higher elevations to hot springs locations (Rocchio et al 2006).

At Filoha, the temperature of the water at the pumping station in the middle of the meadow is 130° F (Johnson 2007). The process of snowmelt seeping through porous rocks and percolating underground to be heated close to the earth's mantle, and then following fault lines to the surface, creates the hot springs in this area south of Glenwood Springs. It is the saturated, warm ground that allows this obligate wetland species to thrive here. This meadow supports diverse and abundant insect populations, including *Epipactis gigantea*'s pollinators, syrphid flies, which abound.

In 2007 and 2008, I studied the stream orchid in the hot springs' meadows there, at the middle level of ►



View of hot springs meadow with *Epipactis* locations flagged. © Rea Orthner



Epipactis gigantea elongates and grows taller in shady habitats. © Denise Wilson

◀ three Colorado locations of varying elevations. The pollination biology research that became my master's thesis concluded that this species reproduces about equally in three ways: cross pollination, self-crossing through senescing pollen, and via clonal rhizomes, with cross-pollination being the native state. The most common pollinator found was the syrphid fly species *Sphaerophoria philanthus*, but *Eupeodes volucris* was also captured and identified at Filoha.

The project: Peak Ecological Services studies population stability and safe, effective weed control

In 2018, Rea Orthner with Peak Ecological Services LLC started research, funded by Pitkin County Open Space, to determine the extent, numbers, and stability of this species, and to determine the best way to control the noxious weed *Cirsium arvense* (Canada thistle) without harming the rare plants. I have been fortunate to assist in this project. For the past three years, we have collected data in 14 transect plots, plus a heavily populated *Epipactis* macroplot, to gain insight into this species' population numbers and stability, and to help steer the land management of this rare plant.

The Peak Ecological Project has shown that the *Epipactis* population is stable with an extrapolated estimate of 300,000 ramets (aboveground stems) at Filoha. In 2020, the density of the orchid population was slightly less than in 2019, but in both years, numbers had rebounded from a drought in 2018. The orchid density appears to be highly correlated with precipitation patterns of the preceding winter and spring, with lower densities observed in hot, dry years. We observed no adverse effects to the stream orchids from Canada thistle (*Cirsium arvense*) sample plot

control efforts, which included both herbicide and mechanical (hand-pulling) treatments (Peak Eco 2020 Monitoring Report). To date, the Canada thistle rust fungus, *Puccinia punctiformis*, a biological control agent, has yet to become established despite two years of releases, and hence its utility is unknown (Rosen 2020.)



Epipactis flower stalk with seed capsules (August 2007)
© Denise Wilson

The CoNPS-funded adjunct project: Capsule production study on *Epipactis gigantea*

"Seed set" is the end result in the production of capsules that enclose the seeds. In *Epipactis gigantea*, as in all Colorado native orchids, the capsules enclose and protect hundreds to thousands of minute seeds which have no endosperm and are as fine as dust particles. (I like to say that orchid moms do not pack a lunch!) The capsule is the container that protects the delicate seeds until they fully develop. No capsule = no seeds. At the end of the season, the dried capsules dehisce and split, opening to disperse the seeds to the wind, on animals, or to the ground. Being so light, these seeds can be carried many miles on wind currents, but if they land on the ground, the symbiotic fungi species associated with the orchid species must be present for germination to occur.

Although the population of *Epipactis gigantea* at Filoha seems highly stable, I chose to do an adjunct study to the Peak Ecological Project to determine the long-term health of the plants, as indicated by the end result—seed capsule production. What concerned me was the noticeable reduction in the number of seed capsules on the plants there, as compared to conditions I witnessed and data I collected in 2007 and 2008. CoNPS gave me a Myrna Steinkamp Grant in 2019 to support this work.

Six of the 14 transects in the Peak Ecological Project supported enough density of *Epipactis* plants to enable me to track a total of 144 plants, individually tagged, by height, number of leaves, number of flowers, and subsequent number of seed capsules produced. In each of the six transects, 24 plants were tracked through their phenology.

Results

Individual ramets (144) of the *Epipactis* populations were systematically tracked and sampled for height, numbers of leaves, flowers, and capsules in 2019 and 2020. Statistical analysis was performed using the Wilcoxon test of paired samples.

As shown in Figure 1A, the average height (cm) of the sampled plants was higher in all transects (T) in 2019 than in 2020, although these results did not reach statistical significance.

In 2019, in most transects, the average number of leaves produced in each transect was greater than in 2020, although these differences did not reach statistical significance (Figure 1B). Transect T11 is alongside the Crystal River and benefits from a consistently high-water table. Transect T14 is partially shaded by a *Juniperus scopulorum*. These two mitigating circumstances may account for better ►

◀ growth in plants of T11 and T14 in the drier year, 2020, as the soil maintains moisture throughout the season, even into the drier part of summer.

The average number of flowers developed in each transect was statistically significantly higher in 2019 than in 2020 (Figure 1C). As shown below in the weather analysis, the precipitation was higher for 2019 than for 2020. This comparison points to favorable flower production only in years of adequate moisture.

The average number of capsules produced per transect was greater in 2019 than in 2020, with the exception of Transect 14 (shaded by *Juniperus scopulorum*). Three transects, T7, T9, and T10, produced *no capsules at all* in the sampled plants of 2020; and T8 produced 1 and 6 capsules on two plants, respectively. T11 produced 1 capsule on one plant. In August 2020, most of the flowers observed were shriveled and brown and did not develop normally. The tops of many plants had been browsed, and though this is an indeterminate species, these ramets did not further develop.

The Wilcoxon statistical t-test of paired samples (2019 to 2020) for the number of flowers and capsules appears in Figure 2. There is a significant reduction in number of flowers from 2019 to 2020 (Figure 2A). In other words, the results show a significantly higher average number of flowers per plant in 2019 than in 2020.

The average number of seed capsules produced is significantly higher in 2019 than in 2020 (Figure 2B), as might be expected, considering the average number of flowers produced was higher in 2019 than in 2020. In 2020, there were only 8 plants of the 144 sampled which produced capsules, and statistically, it shows up as zero capsules in this graph!

A statistical analysis comparing 2007 with 2019 and 2020 was not possible because there were many fewer plants used in the control group (wild) in 2007 with no pollination treatments—only 24 plants—as compared to the 144 plants sampled in each of the years 2019 and 2020. Nevertheless, we can look at the averages of flowers produced per plant, as seen in Figure 3. It is interesting to note that the average number of flowers per plant in a wild population in a year with good precipitation (2019) is the same as a small sample of flowering plants in 2007—that is, about 5 flowers per flowering plant.

In this study, *Epipactis gigantea* showed a numerical reduction of capsules produced from the number of flowers sampled, down from 44.5% in 2007, to 25.4% in 2019, and 24.4% in 2020.

This species requires a constant supply of water. The hydrology of the meadow matters! The results of the plants' health appear to follow the weather patterns ►

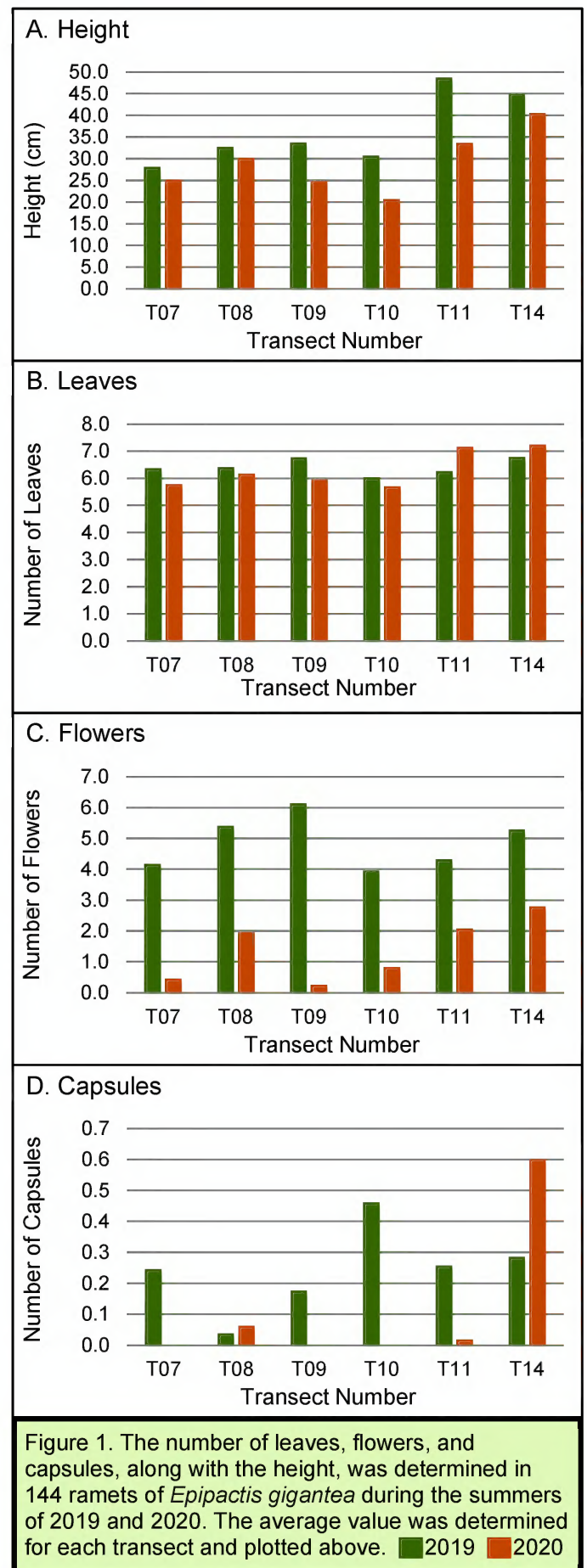


Table 1. Precipitation (inches) for the 2018, 2019, and 2020 Water Years compared to Baseline

	2018 Water Year	2019 Water Year	2020 Water Year	Baseline (2008-2020 Water Years)
Fall (Oct-Dec)	2.87	4.51	2.34	3.26
Winter (Jan-Mar)	2.79	5.1	3.26	3.24
Spring (Apr-Jun)	3.43	5.95	2.17	3.70
Summer (Jul-Sep)	3.05	2.59	2.60	4.22
Annual Total	12.14	18.15	10.37	14.43

water years were drier than the baseline, and that the 2019 water year was much wetter than baseline. More specifically, the total precipitation was 12.14 inches in 2018, 18.15 inches in 2019, and 10.37 inches in 2020. The average for all years of record (2008–20) was 14.43 inches. When broken down into seasons, the data show that the spring of 2020 had about 1.5 inches less rain than baseline, 2019 had over two inches more precipitation than baseline, and 2018 had only slightly lower precipitation (about 0.5 inches) lower than the baseline. See Table 1 and Figure 4.

The term "water year" is a term commonly used in hydrology to describe a time period of 12 months for which precipitation totals are measured. It is defined as the 12-month period beginning October 1 for any given year, through September 30 of the following year. The water year is designated by the calendar year in which it ends, which includes 9 of the 12 months. Thus, the year ending September 30, 1999 is called the "1999" water year.

Like precipitation, the streamflow for 2018, 2019, and 2020 showed a similar pattern of above-normal flows in 2019 and below normal in 2018 and 2020.

However, 2020 river flows were still slightly higher than in 2018. Streamflow data was taken from the US Geological Survey Crystal River Above Avalanche Creek station (USGS 09081600), located in the northern portion of Filoha Meadows Nature Preserve across the river from Penny Hot Springs. The water-table level in Filoha Meadows is supported by the streamflow of the Crystal River.

Temperature data was gathered from the Crown Colorado (USR0000CCRO) station located approximately 11 miles northeast and about 1,500 feet higher in elevation than Filoha Meadows. The data show that May 2020 had a higher average monthly ►

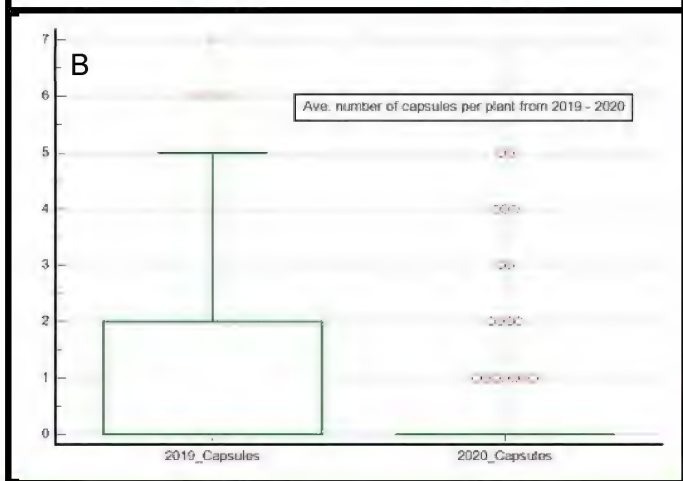
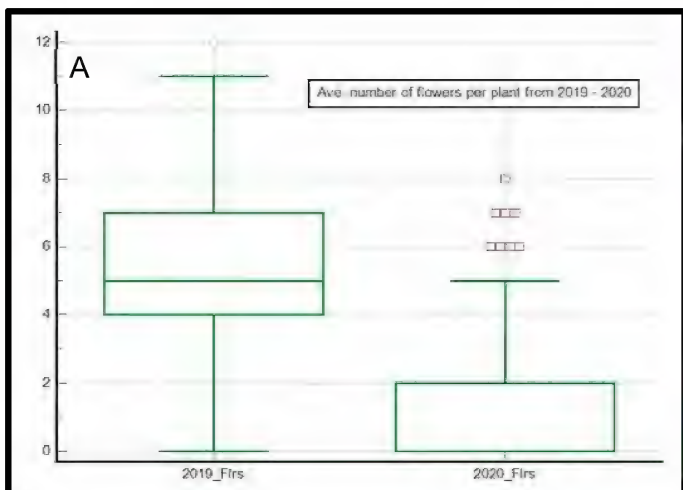


Figure 2. A. Wilcoxon paired t-test of flowers for 2019 and 2020. B. Wilcoxon paired t-test for average number of capsules per plant for 2019 and 2020.

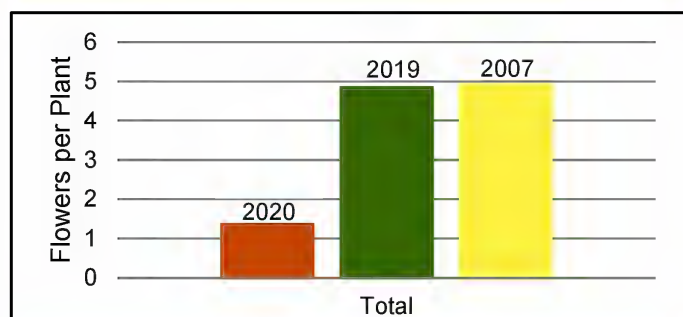


Figure 3. Average number of flowers per plant.

◀ of the previous winter and spring, as shown by the following analysis of precipitation, temperature, and streamflow. This analysis was completed by Rea Orthner.

Precipitation and temperature analysis by Rea Orthner

Precipitation data was gathered from the Carbondale 0.5 W (US1COGF0047) station located approximately 12 miles north and about 600 feet lower in elevation than Filoha. The data show that the 2020 and 2018

◀ temperature than baseline, similar to 2018 (Figure 5). Then June and July of 2020 were closer to baseline values, but lower than in 2018. The data also show that the 2019 spring and early summer (May through July) had lower average temperatures than baseline years, while 2018 had much higher temperatures than baseline. These temperature differences are likely correlated with the precipitation patterns, with cooler average temperatures associated with relatively high precipitation levels (mostly as snow) as observed in 2019, and a warmer and drier season in 2018. See Figure 5.

Conclusion

As a wetland plant, the growth, flowering, and seed set of *Epipactis gigantea* appears to closely follow weather patterns of moisture and heat. It also may be correlated to the groundwater level resulting from stream flow. Having a rainier and cooler water year in 2019 benefited the plants' health and allowed more flowers and subsequent seed set. The plants did rebound from a dry year (2018) to fully develop and produce flowers and seeds the following year. This study confirms that under stressful conditions, *E. gigantea* stores its energy as rhizome growth, which is typical of competitive species preempting abiotic (rain) resources (Rocchi et al 2006). Other multiple threats to this species should be mitigated, as they compound the risk to Filoha's sensitive *E. gigantea* population.

Several samples of *Epipactis gigantea* leaves, roots, and soil surrounding the roots were submitted to the North American Orchid Conservation Center, from the 2019 and 2020 survey periods. Current funding does not allow for genetic testing. However, the mycorrhizal fungi associated with the Filoha *E. gigantea* samples has been identified by NAOCC scientists as belonging to the *Tulasnella* genus, which is an effused (patch-forming) fungus. The NAOCC is a coalition of organizations dedicated to conserving the diverse orchid heritage of the U.S. and Canada through research and cooperation.



Denise assisting in Transect 11, along the Crystal River.
© Rea Orthner

This study will extend into 2021, sampling the same plants and studying the same data to supply a third year of examination. Genetic samples will again be sent to the NAOCC laboratories.

Denise Wilson completed her master's degree in 2009 from the University of Colorado, Denver, in Integrated Sciences — Botany, Geology, and

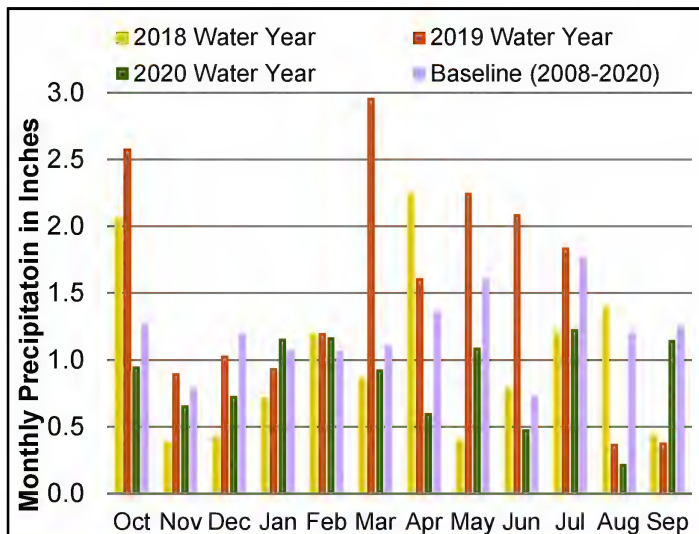


Figure 4. Precipitation for the 2018, 2019, and 2020 water years as compared to baseline.

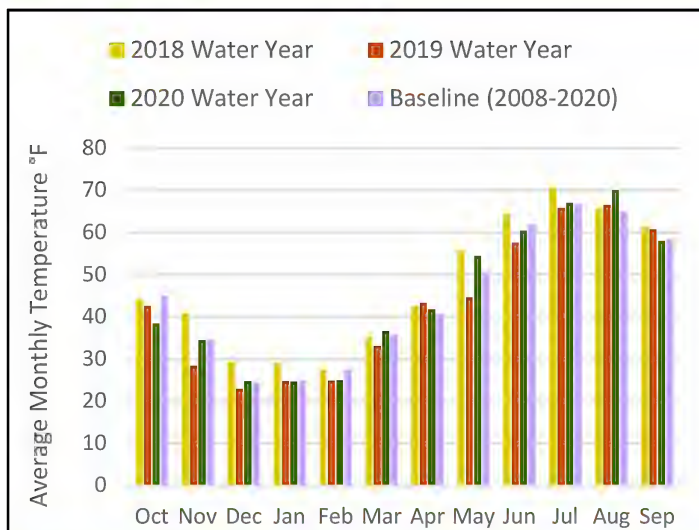


Figure 5. Temperature for the 2018, 2019, and 2020 Water Years as Compared to Baseline.

Geography, with a GIS Certificate. She started collecting seed in 2006 for the Chicago Botanic Garden's seed-bank programs and, until 2018, for the Dixon National Tallgrass Prairie Seed Bank. A volunteer for Wildlands Restoration Volunteers, Nature Conservancy, Colorado Natural Areas, and Colorado Native Plant Society, she served on the Board of Directors of CoNPS as secretary from 2014 to 2017. She currently serves as marketing and events coordinator.

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◀ “Manzanitas...” continued from page 7

The larger native manzanita species mentioned in the above article (*Arctostaphylos x coloradoensis* ‘Panchito’ and *Arctostaphylos patula*) give small songbirds and mammals year-round cover by way of evergreen branches. Leaf litter collects underneath and supports insects, and flowers supply nectar and pollen for bees. The sources for this information are listed below and will have more information for the gardener.

For readers trying to do their best for wildlife but finding terms like *native*, *cultivar*, *hybrid*, and *nativar* confusing, please see Ann Grant’s *Aquilegia* article, “How Native Is Native Enough?”: https://conps.org/wp-content/uploads/2019/06/Aquilegia_2019_43.2_Spring.pdf.

On the CoNPS website, wildlife gardeners will find individualized plant lists for the five major Colorado regions. *Arctostaphylos* species are suggested for two of those (mountains above 7,500 feet and Western Slope below 7,000 feet). The featured article in this issue, as well as other plant lists for pollinators, suggest that manzanitas also can thrive and benefit wildlife in other regions of the state, such as the Front Range. GH

Additional resources

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“Hair” and Its Role in Plants

By Mary Menz

Plants, like people, have many kinds of hair. The terminology for types of human hair is quite limited, however, compared to the terminology for plant hair. According to George Wagner, professor emeritus in the plant and soils science department at the University of Kentucky, there are more than 300 words to describe plant hairs.

Known as trichomes, plant hairs grow from the epidermis or outermost layer of a plant's cells. Trichomes provide multiple benefits to a plant, including:

- Making it difficult for detrimental insects to land on or chew on plant parts and, conversely, providing safe havens for smaller beneficial insects to do their business.
- Providing shade against harsh ultraviolet light.
- Creating conditions favorable for transpiration and to prevent desiccation.
- Excreting salts or other compounds that deter herbivores.

Plant hair can occur on the stem, the leaves, the flower, and even the fruit of your favorite native plant. Not all of them are visible to the naked eye, yet seeing them and understanding the specific vocabulary of trichomes is critical to identifying a specific species. Imagine lying on the ground looking through a hand lens while a friend reads from a dichotomous key. Quickly identifying the plant results in less time on the ground, which is better for the habitat in which plants are growing! This is especially important in vulnerable areas of alpine tundra.

Some trichomes, such as the hairs found on the leaves of prairie coneflower (*Ratibida columnifera*), are coarse to the touch and may protect a plant from grazing by animals. Other trichomes are hispid, or bristle-like, and excrete irritating compounds such as those found on the stem and lower leaf surfaces of stinging nettle (*Urtica dioica*). But often, the soft hairs like those that cover so many parts of the early-blooming pasqueflower (*Anemone patens* L. var. *multifida*) provide protection from temperature swings that could kill the plant's fragile cellular structures.

Depending on the key or book being referenced in the field, the pasqueflower features many hairy plant parts. These plant parts are described as wearing a “furry coat of silky hairs,” “achenes that are villous with plumose beaks,” and “long feathery styles at maturity.” The early bloom of this wildflower nearly guarantees that it will be covered with late-season snow or frost, but its dense covering of trichomes protects it from freezing and dying before the plant has time to set seed.

Many of the low elevation, early-blooming *Cryptantha* species are hirsute. The hairy coats worn by their leaves also protect them from unpredictable—and variable—spring temperatures. A survey of early-blooming plants reveals many other species that benefit from these types of hairy features. And even more plants exhibit trichomes as the summer wildflowers bloom in the alpine. ►



Pasqueflower (*Anemone patens* L. var. *multifida*). This wildflower blooms from March to July at elevations of 5,400-13,000 feet. An endearing description of this hairy plant is found in Janis Lindsey Huggins's book *Wild at Heart*. Huggins says that “early Native American tribes called pasqueflowers ‘ears of the earth,’ because their furry ears pushed up from the earth soon after snowmelt to ‘listen for the faint rustle of summer.’” © Carol English



Old-man-of-the-mountain (*Hymenoxys grandiflora*) is easily recognized in the alpine tundra: it is the largest-diameter flower above the timberline. Dense, villous, woolly hairs cover most of the stem and involucre. It gets its common name from the white, beard-like hairs. © Kelly Ambler

◀ Definitions of Common Trichomes

The only way to truly differentiate—and appreciate—the various kinds of trichomes is to study them with a hand lens and then compare observations with other plants. Practice leads to confidence, and soon the vocabulary becomes second nature.

The following are some of the most common terms referring to trichomes. Following each definition is an example of a relatively common native plant with the kind of trichome defined.

Arachnoid: dense arrangement of hair, like a cobweb. Observe the leaves and back of the flower head of old man of the mountain (*Hymenoxys grandiflora*).

Canescent: dense, short, gray or white hair. Observe the leaves of four-wing saltbush (*Atriplex canescens*).

Glabrous: few or no trichomes; bald. Observe the leaves and stem of Rocky Mountain penstemon (*Penstemon strictus*).

Glandular: hair with obvious glands at ends. Observe the stem of sticky purple geranium (*Geranium viscosissimum*).

Hirsute: very hairy, bristle-like. Observe the inflorescence, or flower, of sugar bowls (*Clematis hirsutissima*).

Hispid: stiff and rough. Observe the stem and underside of leaves of stinging nettle (*Urtica dioica*).

Pilose: long and soft. Observe the postulate, or pimple-like, hairs on the leaves of streamside bluebells (*Mertensia ciliata*).

Plumose: like a feather or plume. Observe the wispy styles on mature prairie smoke (*Geum triflorum*).

Pubescent: slightly hairy; the opposite of glabrous.

Tomentose: compactly pubescent, white and woolly. Observe the leaves of cushion buckwheat (*Eriogonum ovalifolium*).

Villous: more dense than pilose; less dense than tomentose. Observe the stem and leaves of orange agoseris (*Agoseris aurantiaca*).

Woolly: long, soft, entangled hairs.

After mastering the identification of these common types of trichomes in the field, move on to the more than 290 others!

Resources

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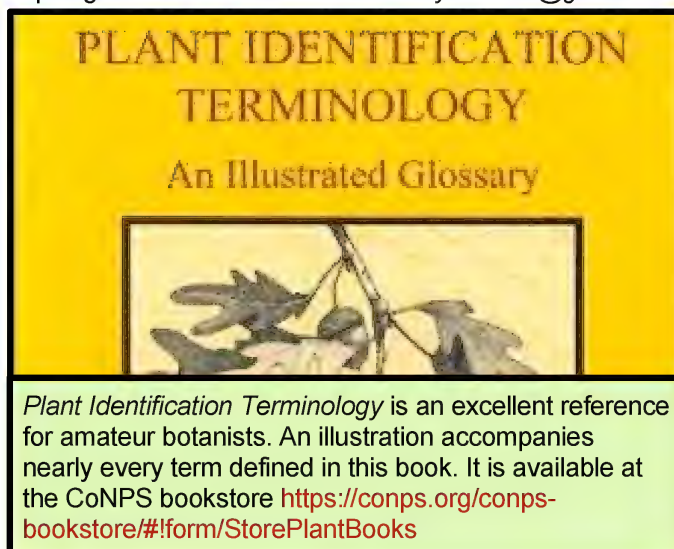
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Mary Menz is a career writer and editor and a Colorado Native Plant Master®. She co-teaches the NPM courses on the Western Slope. Some of her favorite summertime moments are lying on the ground identifying wildflowers. She recently retired from her managing editor position with Aquilegia. You can reach her at mary.t.menz@gmail.com.



Plant Identification Terminology is an excellent reference for amateur botanists. An illustration accompanies nearly every term defined in this book. It is available at the CoNPS bookstore <https://conps.org/conps-bookstore/#!/form/StorePlantBooks>

Will Colorado Protect Rare Plants from Oil and Gas?

By Brad Klafehn

Government rulemaking hearings are not supposed to be exciting—quite the opposite. Especially during the pandemic, they can go on for months with lawyers droning, members of the public getting their three minutes' worth of virtual face time, and decision makers addressing each other over Zoom in an oddly formal manner as their dogs bark in the background: "Thank you, Commissioner Doe. As Hearing Officer Smith, Assistant Attorney General Jones, and Director Roe have just made clear, the appeals process under rule 309e2 is not designed to ..."

Not exactly riveting theater.

But Senate Bill 19-181 (2019) was coming down to the wire. It would change the role of the Colorado Oil & Gas Conservation Commission from "fostering" oil and gas development to "regulating" it to protect the "181 values": human health, safety, and welfare; the environment; wildlife; and air, water, soil, and biological resources.

Now, after six months of this mission-change rulemaking, the COGCC was about to conclude the final piece of it: the 1200-Series Rules, which are intended to protect wildlife resources. The Wildlife and Biological Resources Coalition—consisting of Audubon Colorado Council, Butterfly Pavilion (represented by CoNPS Board Member Amy Yarger), Colorado Native Plant Society, Front Range Nesting Bald Eagle Studies, League of Oil and Gas Impacted Coloradoans, the Lookout Alliance, and Rocky Mountain Wild—had formed in early 2020 to be the voice for the species that often get overlooked in these rulemakings due to a typical focus on big game and raptors, which are often considered the more charismatic species.

For months, we at WBRC had implored the commission to take seriously the words of Senate Bill 19-181 (the commission "shall regulate oil and gas operations in a reasonable manner to protect and minimize adverse impacts to public health, safety, and welfare, the environment, and wildlife resources and shall protect against adverse environmental impacts on any air, water, soil, or biological resource resulting from oil and gas operations"). Now, we wondered, would they even include the words "biological resource" in the rulemaking? Would they mandate use of the best non-game biological data in the state—that from the Colorado Natural Heritage Program at

CSU—to identify where the species of concern exist, even though other state agencies and oil and gas operators already use CNHP's data for that very purpose? Would they protect all the species described in Colorado Parks and Wildlife's State Wildlife Action Plan, the blueprint for conservation of the state's "Species of Greatest Conservation Need"? Would they even mention the SWAP? Despite the WBRC's numerous briefs and witness testimonies advocating for these items over the previous months, the commission had been oddly silent regarding them, and now time was running out.

Testimony from CoNPS had shown that restricting oil and gas operations to only 30,000 acres of the state, mostly in the barrens and shrublands of northwest Colorado, would protect the 17 rare plant species identified in 2009 by the Colorado Rare Plant Conservation Initiative as threatened by energy development (Figure 1 and Table 1). We at WBRC showed them maps demonstrating the proximity between the rare plants and existing federal oil and gas leases—on which development would now need to be approved by the COGCC under their new ►

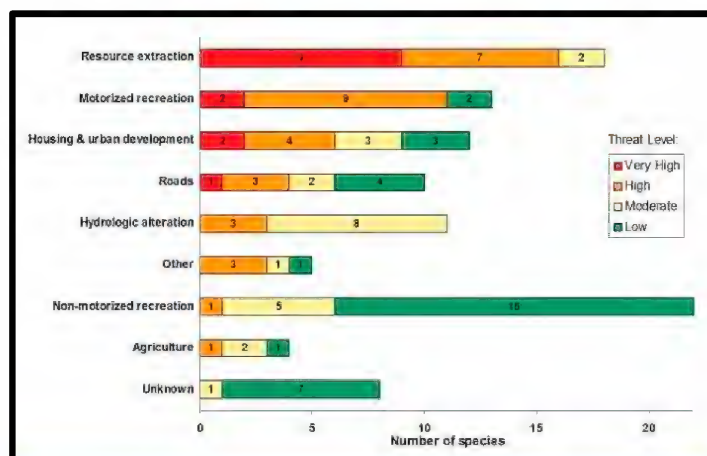


Figure 1. Primary threat types for at-risk plant species. Summary of primary threat types, and the number of species most affected by each type.

Resource extraction includes oil and gas development, oil shale mining, and other types of mining. Motorized recreation is distinct from other types of recreation, such as hiking, camping, hunting, etc. Roads include both construction of new roads and maintenance of existing rights of way. Agriculture includes development of new tilled areas and incompatible grazing practices. The 'Other' category includes effects of exotic species and/or their control, collecting, and herbivory at a level that threatens an entire species.

Table 1. Seventeen plants in northwestern Colorado threatened with extinction because of oil and gas development activities. From Elliott, B. A., S. Spackman Panjabi, B. Kurzel, B. Neely, R. Rondeau, M. Ewing. 2009. Recommended Best Management Practices for Plants of Concern. Practices developed to reduce the impacts of oil and gas development activities to plants of concern. Unpublished report prepared by the Colorado Rare Plant Conservation Initiative for the National Fish and Wildlife Foundation, page 12.

http://cnhp.colostate.edu/download/documents/2009/Plant_BMPs_FINAL_May_6_2009.pdf

Scientific name	Imperilment rank (CNHP 2008)*	Federal Status*	Endemic to Colorado	Occupied acres	Habitat
<i>Astragalus humillimus</i>	G1/S1	LE	No	1,433	Cliff and canyon
<i>Astragalus debequaeus</i>	G2/S2	BLM	Yes	106	Pinyon-juniper
<i>Astragalus osterhoutii</i>	G1/S1	LE	Yes	793	Shrubland
<i>Oreocarya revealii</i>	G1G2/S1S2	BLM (proposed)	Yes	525	Pinyon-juniper
<i>Eriogonum clavellatum</i>	G2/S1	none	No	4	Shrubland
<i>Eriogonum pelinophilum</i>	G2/S2	LE	Yes	1,178	Shrubland
<i>Physaria congesta</i>	G1/S1	LT	Yes	740	Barrens
<i>Physaria parviflora</i>	G2/S2	BLM	Yes	3,272	Barrens
<i>Mentzelia rhizomata</i>	G2/S2	BLM	Yes	4,547	Barrens
<i>Penstemon debilis</i>	G1/S1	C	Yes	60	Barrens
<i>Penstemon fremontii</i> var. <i>glabrescens</i>	G3T2/S2	none	Yes	3,416	Shrubland
<i>Penstemon grahamii</i>	G2/S1	BLM	No	639	Barrens
<i>Penstemon scariosus</i> var. <i>albifluvis</i>	G4T1/S1	C	Yes	124	Barrens
<i>Phacelia scopulina</i> var. <i>submutica</i>	G2T2/S2	C, FS	Yes	586	Barrens
<i>Physaria obcordata</i>	G1G2/S1S2	LT	Yes	473	Barrens
<i>Sclerocactus glaucus</i>	G3/S3	LT	Yes	10,203	Barrens
<i>Thalictrum heliophilum</i>	G2/S2	none	Yes	457	Barrens
Total Acres				28,556	

* Imperilment rank: The Global (G) Rank reflects the conservation status of a species from a global (i.e., range-wide) perspective, whereas the State or "Subnational" (S) Rank reflects the conservation status of a species from a local perspective. A rank of 1 means the plant is critically imperiled; a rank of 5 means the plant is secure. Federal Status codes: BLM: Bureau of Land Management Sensitive; FS: Forest Service Sensitive; LE: listed Endangered; LT: listed Threatened; C: Candidate. Note: scientific names have been updated as necessary.

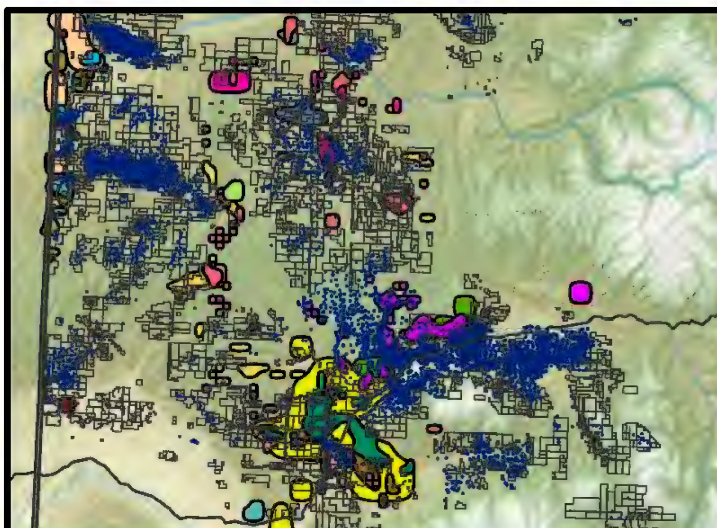


Figure 2. Map demonstrating the proximity between the rare plants and existing federal oil and gas leases.

Legend: federal leases, black rectangles; existing gas wells, blue dots; and rare plant habitats, brightly colored regions. The area shown is approximately from the Utah State line at far left and Grand Junction at bottom left to Rifle at right-center. © Alison Gallensky, <https://rockymountainwild.org/>

◀ protective mandate (Figure 2). We told them that endemic plants are perhaps Colorado's most important unique contribution to the world's biodiversity. And we did this while showing them Zoom pictures of these beautiful native species under threat, some of which are shown in Figure 3.

For several months, the commission had deliberated extensively on items such as waiver and variance procedures, riparian setbacks, setbacks from Gunnison sage-grouse leks versus greater sage-grouse leks, setbacks for sport-fish waters versus Gold Medal waters versus cutthroat-trout waters. Commissioners had discussed in detail how much operators should be charged when compensatory mitigation fees are assessed: should they include or exclude the costs of conservation easements in Pitkin County, since they are so out of line with land costs in the rest of the state? Residential setbacks, venting and flaring, protection of aquifers, restricting occupancy in big-game migration corridors—these had all been addressed in the months previous. ▶



Figure 3. Rare plants threatened by federal oil and gas leases. Clockwise, from top left. Mancos milkvetch, *Astragalus humillimus* © Steve O’Kane; White River penstemon, *Penstemon scariosus* var. *albifluvis* © Dave Elin ; Piceance twinpod, *Physaria obcordata* © Peggy Lyon; Gypsum Valley cat’s-eye, *Oreocarya revealii* © Susan Spackman Panjabi; Colorado hookless cactus, *Sclerocactus glaucus* © Lori Brummer; Parachute penstemon, *Penstemon debilis* © Steve O’Kane; Roan Cliffs blazing star, *Mentzelia rhizomata* © Susan Spackman Panjabi; Clay-loving wild buckwheat, *Eriogonum pelinophilum* © Lori Brummer. Photographs courtesy of the Colorado Natural Heritage Program Rare Plant Guide (<http://www.cnhp.colostate.edu/rareplants/>).

◀ Now the commission was about done—this was the last hour of debate on the last day, and they were moving on to the final category: “miscellaneous issues.” The commissioners had not yet responded to WBRC’s extensive comments on the need to protect biological resources, as the statute demands. They still had not offered a definition of “biological resources,” nor had they discussed the use of CNHP data or the SWAP to guide decisions in the future. Were non-game wildlife and ecosystems really going to be ignored, despite 41 Democratic state legislators having written to the commission to emphasize that when the legislature included “biological resources” in the act, it meant it?

Unexpectedly, Commissioner Bill Gonzalez, the representative of the oil and gas industry on the commission, successfully advocated for including language proposed by Western Resource Advocates

(in coordination with CoNPS). The new language added a requirement for a consultation with CPW, not only when federally designated threatened and endangered species were potentially impacted, but also when Colorado-designated threatened and endangered species were potentially impacted. This meant that CPW would now have to consult on an additional 19 species, including the boreal toad, the burrowing owl, and two butterflies—the Uncompahgre fritillary and the Pawnee montane skipper. On their own motion, CPW had never insisted on being consulted about oil and gas development impacts on these state-designated threatened and endangered species. In the rulemaking hearings, they insisted that their mandate for protection only extended to vertebrates and mussels. Nevertheless, due to Commissioner Gonzalez, at last the wall that kept CPW and COGCC considering only game species, raptors, and grouse had been breached! ►

◀ Then, as the last item of the months long process, the commission did finally address our concerns, not by promulgating the rules we had asked for, but rather by deciding to convene a “Biological Resources Working Group” to develop recommendations for protecting the non-game, and non-charismatic, state species of concern. The final words spoken at the last second of the rulemaking process were those of Commissioner Priya Nanjappa, the designated expert on wildlife resources, reminding staff to please include plants and invertebrates in the scope of the working group. Immediately thereafter, the commission concluded their process by unanimously adopting the Mission Change rules. The members of WBRC were disappointed that the Commission had not incorporated our ideas into the rules, but we knew we had been given a chance to prevail in the end. So, for advocates of protecting biological resources, especially Colorado's rare plants, from the impacts of oil and gas, although our issues were postponed until the last moment, and then postponed until some later time in 2021, the process will continue. Rare plants may still have the chance to extend their roots and tendrils into the regulatory arena. With assistance from Western Resource Advocates, the National Audubon Society, the Backcountry Hunters & Anglers group, and sympathetic counties like La Plata, San Miguel, and Boulder, WBRC has prepared the groundwork for the protection of rare plants, migratory birds, amphibians, reptiles, and vulnerable invertebrates, perhaps for the first time anywhere in the U.S. However, ultimate success is not guaranteed.

The seeds that have been planted have not yet germinated. There is still a lot of work to do to get regulations that truly protect the most vulnerable Colorado species from oil and gas development, as the law requires. There is the challenge of cash-strapped groups paying for our legal representation (please see WBRC's fundraising page for attorney costs, hosted by Rocky Mountain Wild, <https://secure.givelively.org/donate/rocky-mountain-wild-incorporated/support-the-wildlife-and-biological-resources-coalition>). And without continuous oversight and citizen pressure, implementation is often where great policy ideas wither and die. Indeed, in one their first tests of enforcing the “regulating” versus “fostering” paradigm shift, COGCC may be about to fail. In the past several months, WBRC member Front Range Nesting Bald Eagle Studies has documented disturbance of bald eagles in roosting sites on Middle Boulder Creek in Weld County near a well pad, due to water pumping and pressurization. COGCC has thus far denied that

these ancillary operations are covered under the act, but citizens maintain that the act's scope is comprehensive of all oil and gas activities. A hearing on this precedent-setting issue is awaiting scheduling.

In the end, will the commission actually use its power to protect rare plants? Please check the Conservation Committee's updates in future CoNPS e-News issues for continuing developments.

A hole was opened big enough to drive an ecosystem through.

Brad Klafehn is a member of the CoNPS Conservation Committee and CoNPS' representative to the WBRC. Since retiring from the Denver City and County Department of Finance, Brad has been an active weed warrior in state parks and an advocate for

*protection of the South Park fens. He became enamored of native plants after finding a new population of *Sclerocactus glaucus* on the Uncompahgre Plateau in the early 1980s. His activist career began in 1975 working on coal and oil shale issues for the Colorado Open Space Council (now Conservation Colorado). 🌀*

Text from the commission's final Statement of Basis and Purpose establishing the Biological Resources Working Group

“Recognizing the importance of protecting against adverse environmental impacts to biological resources resulting from oil and gas operations, the Commission instructs its Staff to convene a Biological Resources Working Group to evaluate sources of information about vegetation, including rare plants; topsoil; wildlife and wildlife habitat; non-wildlife threatened and endangered species; ecosystems, habitat heterogeneity, and biodiversity; and invasive species management. The stakeholder working group should include Commission Staff, as well as representatives from interested local governments, operators, and community organizations. The Commission intends for the working group to consider sources of information and available data to assist Staff in identifying how to better integrate considerations of biological resources with the Commission's permit review process. Sources of data may include the Colorado Natural Heritage Program, Colorado Parks & Wildlife's (“CPW”) State Wildlife Action Plan (“SWAP”), and federal, state, and local governments. Following a review of these sources of information, the working group will make recommendations to the Commission based on its findings. The Commission directs Staff to coordinate a report back to the Commission based on the results of the Biological Resources Working Group by no later than January 15, 2022.”

The Woody Artemisias: The Species and Their Propagation Part 3 of a Series

By Jim Borland

This concludes our multi-part series of articles on the Artemisia genus and its species. Common names include sagebrush, wormwood, and mugwort. This article describes individual Artemisia species and their methods of propagation.

The Species

The complex of woody *Artemisia* species is currently in a dynamic state of evolution and hybrids among species and subspecies are common. Featured in this issue are *Artemisia* species more commonly found in the nursery trade. Descriptions of many additional species, and more information on propagation can be found on the CoNPS website (<https://conps.org/learn/woody-artemisias-by-jim-borland/>).

***Artemisia cana* ssp. *cana* (silver or plains sagebrush).** An erect, rounded, and freely branched shrub 3–5 feet tall with densely hairy, white- to yellowish, young bark, which becomes brown with age. Leaves of the vegetative branches are large, linear, and densely covered with a silky pubescence. Flowering heads are usually arranged into dense, leafy panicles, which bloom in September.

It is dominant over 34 million acres of its range, which includes the Missouri Plateau, from southern Alberta and Saskatchewan, Canada, southward, mostly east of the Continental Divide, through Montana, the western and central portions of the Dakotas, Wyoming, northwestern Nebraska, and northern Colorado.

It is found in both sparse and dense stands in a variety of soils in prairies, streamside locations, drainage ways, alluvial flats, and terraces of valley bottoms and upland soils in valleys east of the Continental Divide. These soils are usually lower in nitrogen, phosphorus, potassium, cation exchange capacity, and organic matter than those associated with *A. tridentata* var. *tridentata*. This species was first collected by Lewis and Clark on the banks of the Missouri River.

***Artemisia filifolia* (sand sagebrush).** This sagebrush with six other common names is the most widely distributed shrub species found on sand hills and sand dunes in the West. It is a nanophanerophyte (a shrub less than 6 feet tall) which typically grows 2–4 feet tall. It is freely branched, rounded in form, and has young branches covered in a dense, silvery-white pubescence, while the older branches are covered

With precipitation patterns a key factor in where sagebrush grows, the species are listed below in order of the increasing aridity of their habitats.

Moist

Artemisia cana ssp. *cana*

Semi-dry

Artemisia cana ssp. *viscidula*

A. cana ssp. *bolanderi*

A. tridentata var. *vaseyana*

A. tripartita var. *tripartita*

A. tridentata var. *tridentata*

A. tripartita var. *rupicola*

A. spiciformis

A. arbuscula ssp. *longiloba*

A. arbuscula ssp. *thermopola*

A. tridentata var. *parishii*

Dry

Artemisia rothrockii

A. arbuscula ssp. *arbuscula*

A. rigida

A. tridentata var. *wyomingensis*

A. nova

A. filifolia

Very Dry

Artemisia pygmaea

Experience indicates that *A. spinescens* is similar to *A. nova* or *A. pygmaea* and that *A. frigida* is adaptable to a wide range of aridity.

with a dark-gray or blackish bark. Leaves are filiform or threadlike, silvery white, and often bundled in alternately arranged axils.

This species is an indicator of sandy soil with significant low levels of essential elements and can grow in areas with as little as eight inches of annual precipitation. Its native range is from the southern parts of the Black Hills of South Dakota, to Wyoming, Colorado, Nebraska, Kansas, Texas, Utah, Nevada, New Mexico, Oklahoma, and south to Chihuahua, Mexico. Flowers appear in August to September.

***Artemisia frigida* (fringed sagebrush).** A mat-forming sub-shrub with at least 30 other common names, it has numerous spreading stems from a woody base and erect, leafy, annual herbaceous stems; it grows up to 24 inches tall. The whole plant, including the leaves, ►



Sand sagebrush (*Artemisia filifolia*). © Jen Toews



Fringed sagebrush (*Artemisia frigida*). © Jen Toews

◀ is densely covered with a layer of fine, silvery hairs. Leaves are finely divided like a feather two or three times and are fragrantly aromatic upon crushing.

Found in western North America, Siberia, northern Asia, and Europe, this species is yet another widely distributed and abundant sagebrush. Possessing qualities of both a cool- and warm-season plant, it is not surprising that it occupies a wider range of elevations than any other *Artemisia* species, from low semidesert valleys to 11,000 feet.

A large perennial taproot assists in its ability to inhabit dry, porous, shallow, gravelly, sandy, or coarse loamy soils in zones receiving precipitation of 8–20 inches annually. Reportedly, the species is tolerant of weakly acid, weakly basic, and weakly saline soils.

Blooming can occur from July in higher elevations to November at lower elevations. Seed can remain viable in soil for several years, a factor that allows this species to spread rapidly on disturbed sites.

***Artemisia nova* (black sagebrush).** A small shrub, growing 6–18 inches tall, with erect branches from a spreading base and a less-hedged appearance compared to *A. tridentata* var. *wyomingensis* due to its unpalatability to wildlife. At least six other common names are known for the species.

Dull, grayish sticky hairs cover the evergreen, broadly fan-shaped leaves, which are sharply pungent-smelling. It is generally darker in color than *A. tridentata* var. *tridentata* or *A. arbuscula*, and oilier than the latter, but both gray-green and glossy-green forms are known.

Flowering occurs in August to mid-September, with seeds ripening in October to November. Its red-brown flowering stalks are numerous on erect branches, much denser and darker than *A. arbuscula*, and persistent.

It shows some affinity for calcareous soils covered with a surface rock or desert pavement and is also found on dry, shallow lithosoils overlying bedrock in desert valleys and on mountain slopes. Weakly tolerant of saline soils, it prefers soils with a pH

between 6.5 and 7.5 and thrives in the 6–20 inch precipitation zone. Roots are known to be deep, wide-spreading, and of a generalized type, a factor that allows it to be transplanted easily.

It is most abundant at elevations of 7,000 feet on south and west exposures on wind swept ridges, but also is found at 4,900–7,900 feet, primarily in the Great Basin and scattered in other parts of the West. It is more closely associated with salt-desert habitats than other sagebrushes, except *A. spinescens*.

Although it occupies nearly the same range as does *A. tridentata* var. *wyomingensis*, it occupies shallower soils. Reports list it living for at least 50 years.

***Artemisia tridentata* var. *tridentata* (basin big sagebrush).** This is the species currently in vogue and the one that everyone hopes they will get when growing sagebrush from seed. It is an erect, spreading, heavily branched, unevenly topped shrub 3–6 (15) feet tall and 5–8 feet wide. In protected sites, its trunk can reach 10 inches in diameter. Bark on older stems is gray-brown to black and, with age, shredding.

Its gray-green evergreen leaves are narrowly lance-shaped, gray-canescens, 3-toothed at apex, and have a bitterly pungent aroma. These may persist through two growing seasons, while the more variably shaped spring-flush leaves are shed usually by mid-summer. Flowering stems arise unevenly throughout the crown and produce flowers in late August to October.

Artemisia tridentata var. *tridentata* is the most abundant shrub in western North America. It is found in lowland sites below 7,000 feet, and is an indicator of deep, well-drained, sandy or gravelly, fertile soils. Occupied soils have a pH between 6.5 and 7.5, and, although not noted for having any significant organic matter, they are higher in this regard and in nitrogen, potassium, phosphorus, and cation exchange capacity than that found associated with var. *wyomingensis*.

Although it is generally regarded as intolerant of alkali soils, tolerant ecotypes are known to exist. It is the predominate sagebrush type of the Great Basin, ▶



White sagebrush (*Artemisia ludoviciana*) seeds
<https://commons.wikimedia.org/wiki/File:Artemisialudoviciana1.jpg> Inset: *A. ludoviciana* shrub. © Jen Toews

Editor's note: White sagebrush (not covered in this article) is widely available and is a valuable landscaping plant.

◀ where it inhabits low ranges, usually between 3,000 and 5,000 feet in elevation, receiving 8–16 inches of moisture per year.

Moisture from all precipitation events is captured through a deep and extensive root system.

At least one specimen has been found to be 120 years old, but 100 years is often the age assigned to most old specimens.

A seed selection from Dove Creek, Colorado, and named 'Dove Creek' is currently available. It is characterized by an especially fast growth rate, large stature, and a single- to few-stemmed habit. There is an excellent stand of this species on the west end of Inspiration Point Park, Denver.

Propagation

By Seed

Documentation of artificial propagation efforts with the woody sagebrushes is scanty, indicating either the simplicity with which it is accomplished, or the relative unimportance this activity has for the majority of sagebrush researchers.

Personal experience with several of the species, coupled with documented information, indicates that propagation from seed is both the most efficient and easiest method of reproducing plants.

Artemisia seed is small and should be sowed no deeper than 0.25 inch deep. In most cases reported to date, the presence of light either is necessary or acts as an aid to germination, or, rarely, has no effect. Normal daylight is sufficient for this, or the sown seed may be placed beneath artificial lamps for the duration of germination. Although a rather narrow optimum germination temperature has been found for a few species, other reports and personal experience indicate that seed of the woody sagebrushes germinates over a wide range of temperatures. These

can range from just above freezing to above 86°F, with the former condition resulting in slow germination and the latter in faster germination.

Except for a few species, no seed pretreatment is necessary to obtain high germination percentages from clean and viable seed. Upon contact with water, the seed of many sagebrush species will form a gelatinous mass around the seed, a phenomenon that has been reported to enhance the ability of the seed to germinate in what may be a low-water environment.

It should be firmly stated that most of the woody sagebrushes have an inordinate need for high percentages of soil oxygen when compared with most plants from more moist climates. It is better to pay attention to the soil structure before sowing or transplanting, rather than to attempt to control the oxygen content of the soil through water management. It is not excessive water, but rather the lack of sufficient soil air, that kills roots or hampers their growth and creates conditions conducive to diseases.

Growers should also be aware that many of these woody species exhibit strong tendencies to sending roots deep quickly. This can result in a pot-grown plant with most of the water- and nutrient-absorbing roots at the bottom of the pot, where oxygen is always most limited. This phenomenon emphasizes the absolute need for the utilization of a highly aerated soil mix for these species.

Culture after germination is rather easy when light levels and soil aeration are attended to properly. While actively growing, the larger species will utilize a large amount of fertilizer, but little or none is needed when they are summer or winter dormant. Although the woody species of *Artemisia* are masters at thriving under nearly sterile soil conditions, growth in the greenhouse or nursery will definitely be enhanced by a constant feed from a balanced fertilizer that provides the seedlings at first with 100 ppm nitrogen, later increased to 200 ppm. (A tablespoon of soluble houseplant fertilizer in a gallon of water provides approximately 200 ppm nitrogen.)

Aside from the need for extra aeration, particularly for the dryland species, potting soils of all types and pH levels will probably grow fine specimens.

By Cuttings

Information regarding vegetative propagation is scantier than that for germination. Most evidence and experience indicate that the most appropriate time to take cuttings is from mid-winter to late spring or during the early growth phase before flowering is initiated. Cuttings about 3–5 inches long can be taken and treated with an IBA rooting hormone ranging in concentrations from 0.1–2.0%. The usual ►

◀ applications of mist and bottom heat (65–75°F) should result in rooted cuttings in 4–6 weeks. Due to the hairiness of the various species, mist control can sometimes be tricky, especially for cuttings taken late in the season. Root cuttings should also be successful for those species known to root sprout in nature.

Landscape Activities

Clues to landscape maintenance activities for nearly all native western U.S. shrubs will have to be initially taken from their performance in the wild. We are lucky in that many species have been studied extensively for their reaction to fires, clipping by herbivores, predation of all types, weather, and soils. Although these studies have been designed to assist wildland managers, they also can be of great assistance to landscape managers.

Clues to pruning practices, for instance, are found in the discovery that many of the woody sagebrush species do not stump sprout. Severe cuts into the main stems, then, would probably not recover with renewed growth. On the other hand, those species that either stump sprout, layer, or regenerate from roots or rhizomes probably would produce a new flush of growth after pruning.

Currently, there only a few species of American woody sagebrushes being commercially produced. Undoubtedly, this situation reflects both the current availability and inexpensive cost of water for landscape irrigation and the general reluctance to try new plants, even those that nature has proven worthy through the test of time. When, and not if, this situation changes, the woody sagebrushes will surely command a premier spot on the list of plants able to withstand, without help, conditions anywhere humans wish to live in the western United States, and to look good while doing so.

Suggested References

(There are hundreds of references on *Artemisia*, but the following should get you started in knowing the species.)

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Jim has been fooling around with native plants for more than 40 years in private, commercial, and public venues. His home garden contains 1000s of native plants, most grown from seed at home and now not supplementally watered for 20 years. Jim has written hundreds of articles, given talks too numerous to count, and continues to grow and plant the two or three native plants not yet in his garden. ☞

More on Wormwood

CoNPS Newsletter 1977. Vol 1.6

After the article on dyeing with *Artemisia* in the September October issue of the CoNPS Newsletter, the following note was received from Dr. William A. Weber (University of Colorado) which is both interesting and informative.

Wormwood is a word-trap. The word has nothing at all to do with worms or wood, but is certainly a good example of how the English show how little facility they had (have?) with foreign languages. The source of this word is an Anglo-Saxon word “wermod” that is believed to mean something like “keeper of the mind,” from a supposed belief in the medicinal virtues of the plant bearing this name. Our vermouth, a wine flavored slightly with wormwood, comes from the same source. Wormwood is a British corruption.

Also, people seem to have a bad tendency to spell *Artemisia* with an E – *Artemisia*, which shows that they don't know that is genus commemorates Artemis, the majestic Greek goddess who carried a bow and arrows.

Tips from the Pros

Think before You Buy Soil

By Maggie Gaddis

Although gardeners may not realize it, the global problem of melting permafrost as it relates to the harvest of peat moss for horticultural use is a clear-cut topic. When most of us think about global climate change, our minds and the popular media go straight to concerns for rising sea levels due to polar ice melting, because the flooding of vast coastal areas has an enormous impact on the geopolitical landscape of the United States. Nearly 40 percent of all Americans live in a county that contains shoreline.

One thing we rarely think about is the consequence of frozen lands melting.

Frozen lands in high latitude landscapes are called permafrost, and their melting represents one of the largest contributors to global climate change. Not only does this contribute to sea level rise, but the melting also plays a role in releasing carbon into the atmosphere.

Frozen and waterlogged plants and microbial organisms do not release carbon. They are therefore carbon sinks. When temperatures rise, ice turns to water and biological activity resumes. Microbes release carbon dioxide as a product of cellular respiration. The thawing plants are their source of carbon. The bacteria decompose the photosynthetically-complex molecules in the plants, thereby releasing carbon into the atmosphere.



Permafrost thaw ponds in Canada.

<https://blogs.ei.columbia.edu/2018/01/11/thawing-permafrost-matters/>

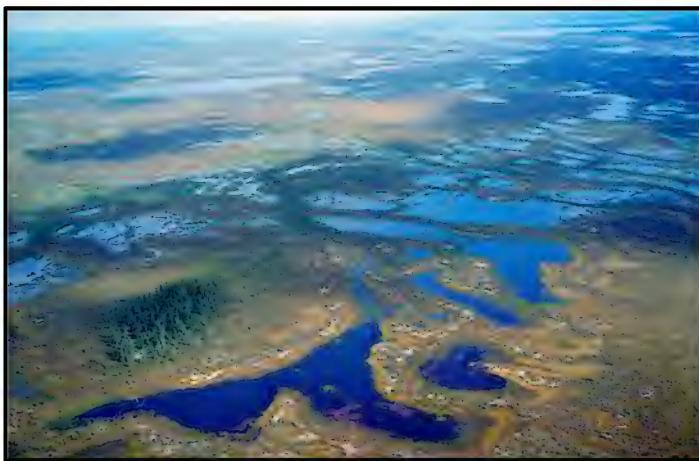
You might think, “What can I do about that?!?” There is yet another chapter to this story. A little farther south, places like Finland, Ireland, Northern China, and Canada are covered in peat bogs. These are wetland ecosystems in which plant materials, chiefly sphagnum moss, are permanently saturated with cold water. Peatlands develop in cold and saturated environments where decomposition is extremely slow, taking thousands of years to accumulate. They exist in landscapes with permafrost, as well as in environments further to the south. These areas are part of the important carbon sink found in the high-latitude environments of the far north. Additionally, peatlands play an important role as biofilters of water, representing 75 percent of all carbon stored in terrestrial ecosystems. Peat moss is considered a nonrenewable resource in light of the slow development of peatlands.

Despite being considered a nonrenewable resource, peat moss is the primary component of potting soil. Who knew? When most people set their minds to gardening, they are trying to do something good for the environment. The harvest of peat moss for the horticultural industry is a pressing concern for global climate change (<https://www.bhg.com/gardening/how-to-garden/peat-moss/>, and <https://www.life.ca/naturallife/0712/asknlpeat.html>). ►



A collapsed block of ice-rich permafrost along Drew Point, Alaska. Coastal bluffs in this region can erode 20 meters/year (~65 feet).

[https://commons.wikimedia.org/wiki/File:Climate_Impacts_to_Arctic_Coasts_\(32682616471\).jpg](https://commons.wikimedia.org/wiki/File:Climate_Impacts_to_Arctic_Coasts_(32682616471).jpg)



Carbon release from Siberian thermokarst lakes.
<https://arctic.ru/news/20190423/849864.html>

◀ Every year, just as the melting permafrost resumes the carbon cycle, the harvesting of peat moss also releases vast stores of carbon. No amount of backyard gardening will sequester enough carbon into the soil to make up for the carbon released into the environment by peat mining.

The good news is you can do something about this! The next time you go to buy potting mix or soil amendments for your garden, read the ingredients and make sure what you are buying does not contain peat moss. There are many alternatives to traditional potting soil that derive from recycled products. My favorite soil product is made of commercial compost, forestry byproducts, and coco coir, a fiber derived from the outer husk of a coconut and a byproduct of the coconut industry. No peat moss required. Other alternatives include wood-based materials (e.g., wood fiber, sawdust or composted bark), pine needles, leaf mold, and paper, to name a few. Each has its own pros and cons, so do your research!



<https://www.indefenseofplants.com/blog/2015/5/4/the-truth-about-peat>

Read more at

<https://www.gardeningknowhow.com/garden-how-to/soil-fertilizers/peat-moss-alternatives.htm>

or

<https://www.gardenmyths.com/peat-moss-alternatives/>

While it is possible to influence your ecological footprint by driving less, eating a plant-based diet, and turning the water off while you brush your teeth, it is also possible to tread more lightly on the Earth by making responsible consumer choices in the garden.

Maggie currently teaches biology, resource management and conservation and sustainability courses at the University of Colorado – Colorado Springs. Maggie is the CoNPS Southeast Chapter President, a restoration ecologist, and an ecological gardener. Maggie and Colorado Native Plant Society (CoNPS) colleagues are working to develop a CoNPS citizen science program in which CoNPS members collect photo data using iNaturalist to support Budburst phenology research and other local research efforts. See iNaturalist working group meetings for more information: <https://conps.org/mfm-event-list/#!event-list> 🌀

Leucocrinum montanum

By Arthur Clifford

Tufts of Sand Lily white bridal bouquets
 Offered to hand maidens on early spring days

Hardy perennial of fleshy deep root
 Handsome green groom a thin lapel suit
 Lifting inflorescence to the moonlight above

The star of the mountain blooms from the glove



Sand lily (*Leucocrinum montanum*), Reynolds Park Open Space.

News, Events, and Announcements

Please check the **Calendar of Events** online at <https://conps.org/mfm-event-calendar/#!/calendar> for the latest information on all events. With the evolving COVID-19 situation, CoNPS is currently not hosting any in-person, indoor events. The status of future CoNPS events might also change.

CoNPS may offer some chapter meetings, workshops, and lectures as webinars or other online meetings. Other events might be postponed or canceled. Field trips are also being scheduled, but may be canceled or postponed. These will be posted online and will be promoted via the CoNPS E-News.

Announcements

We are pleased to announce the 2021 CoNPS grant recipients. Congratulations to all!

Myrna P. Steinkamp Memorial Fund recipients

Andrew Gaier (\$1000), "Assessing the effects of climate change on a rare endemic chasmophyte (*Telesonix jamesii*)"

Ross McCauley & Aurea Cortés-Palomec (\$1550) "Conservation genetic analysis of the rare Chapin Mesa Milkvetch (*Astragalus schmollii*) from lands of the Ute Mountain Ute Tribe"

Alexandra Seglias (\$1025), "How does increased temperature resulting from climate change affect the growth, reproduction, and survival of two rare Colorado alpine plants?"

Denise Wilson (\$500), "Quantifying *Epipactis gigantea* seed set within plots subjected to three Canada thistle eradication methods"

John W. Marr Fund recipients

Blyss Bieber (\$800), "How does the response of bee communities to fire affect Colorado fitness of an important native plant?"

Alyssa Iverson (\$750), "Soil seed bank composition of an urban canal undergoing hydrologic change"

Valerie Martin (\$1000), "Microbial facilitation of floral exploitation in a subalpine pollination mutualism"

Justin Yow (\$1000), "Understanding how climate variability within the Colorado Rocky Mountains affects fuel load dynamics in ponderosa pine (*Pinus ponderosa*) forests"



Access to Colorado's State Wildlife Areas and State Trust Lands

By Bob Dean

Colorado is fortunate to have a substantial amount of land set aside for wildlife-based recreation. Colorado Parks and Wildlife manages more than 350 State Wildlife Areas and nearly 240 State Trust Lands. The State Wildlife Areas were acquired using funds from hunters and anglers (license fees, federal tax on equipment, etc.). As our state's population has increased, so has the usage of these parcels. Most concerning is the increase in activities that disturb and displace wildlife in areas that exist primarily for the benefit of wildlife. Activities that have increased dramatically over the past few years range from illegal camping to non-wildlife related recreation.

In 2020, the Colorado Parks and Wildlife Commission, a citizen board, passed a regulation requiring a valid hunting or fishing license for each person entering one of these areas. Since the majority of the CPW budget for SWAs is supported by hunting/fishing licenses, the goal was to have non-hunters and non-anglers financially contribute to wildlife conservation when using state lands. All other regulations related to access remain in place (seasonal closures, restricted activities, etc.). Special permit and commercial use permit holders are exempt.

After the decision, birders, paddlers, and others in the "non-consumptive user" community, many represented by the Wildlife and Habitat ►

◀ Roundtable, requested that the commission create a new permit for that category of visitor. Native plant enthusiasts fit into this visitor category. The new permit is now available and is called the Colorado State Wildlife Area Pass. This pass will allow access to SWAs and STLs in accordance with other restrictions (closures, use restrictions, etc.) in place of a hunting or fishing license.

Pricing is in line with the lowest cost fishing licenses. Senior and low-income permits will also be available, priced in line with fishing licenses. The price for this permit, as with all CPW licenses, is tied to the Consumer Price Index and so will see possible year to year changes.

Links

Purchase your passes here:

<https://www.cpwshop.com/purchaseprivilege.page>

A complete list of State Lands:

<https://cpw.state.co.us/Documents/RulesRegs/Brochure/lands.pdf>

More information on SWAs, passes, FAQs, etc.; can be found on the CPW website: <https://cpw.state.co.us/>
Bob Dean is a professional nature and travel photographer, author of a series of eBooks on various aspects of photography and member of several conservation organizations and committees. More information can be had on his website: <https://www.viewsofnaturephoto.com/>. Feel free to email him at viewsofnature@comcast.net.

Editor's note

The Wildlife and Habitat Roundtable was established in 2016 to provide a vehicle by which CPW could communicate with the "non-consumptive" user community. The Roundtable was complementing the Sportsman's Roundtable that represented the hunting, fishing, and trapping folks. Given the eclectic nature of non-consumptive users, the list of organizations invited to participate was, and still is, pretty long. Members needed to be supportive of the mission of CPW as the only real criteria to join (no anti-hunter groups). The purpose of this relationship is a two-way communication path between CPW and the community of people who are not necessarily hunters or anglers. ☯

CoNPS Garden Tours

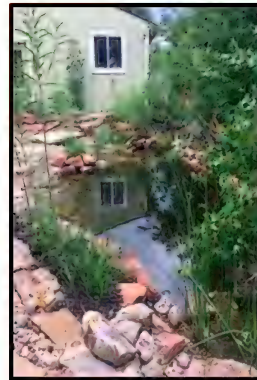
Each tour location offers multiple sites in gardens featuring native plants. See the CoNPS website for registration <https://conps.org/mfm-event-calendar/#!calendar>

June 5, 9 AM – 5 PM

In-person South Denver Garden Tour



Donna Baker-Breningstal's garden (pictured to the left) is featured in this year's Denver Garden Tour, along with other award-winning gardens: Panayoti Kelaidis' personal garden, pictured above (Denver Botanic Gardens and North American Rock Garden Society); Marcia Tatroe, author; Donna Baker-Breningstal (amazing gardens); Cindy Newlander (also of Denver Botanic Gardens); Jenifer Heath (Audubon Habitat Heroes); and the public garden, Babi Yar Memorial Park. Join the tour for inspiration!



June 12, 9 AM – 5 PM

In-person Loveland-Fort Collins Garden Tour

John Giordanengo's Backyard Wetland (pictured) is an authentic slice of a native fen in the middle of suburbia! Other hosts include Annemarie Fussell (of Wildlands Restoration Volunteers); Jude Friend; the gardens of High Plains

Environmental Center; Chapungu Sculpture Gardens, and the conservation gardens of River's Edge.



June 26, 9 AM – 5 PM

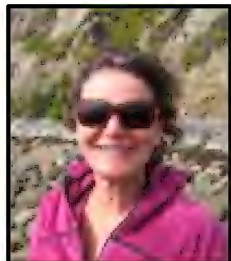
In-person Boulder-Longmont Garden Tour

Our Boulder and Longmont members have some beautiful gardens, and this year we get to see some new

ones! Our hosts include Ron Wittmann, author of the *Colorado Flora, Eastern and Western* books; Stuart Cummings, a CoNPS Gold Certified Native Garden; Dave Sutherland, retired Boulder Parks; Ingrid Moore, a Habitat Heroes garden; the CSU Extension office in Longmont's native plant demonstration garden; and the ever-popular Linda Boley's gardens. ☯

CoNPS Webinars

See the CoNPS website for registration <https://conps.org/mfm-event-calendar/#!calendar>



May 23, 9:00 AM - 12:00 NOON **How Colorado Plants Respond and Adapt to Their Environment** **Presenter: Stephanie Mayer, PhD**

Have you ever wondered how plants survive in the many environments of Colorado? Take a trip through Colorado's ecosystems to understand how plants adapt to particular environments. We will begin with a crash course on the essentials of plant physiology and anatomy, then we will visit the ecological systems recognized by the Colorado Natural Heritage Program: alpine, forest and woodland, grassland, shrubland, steppe and savanna, sparse and barren, and wetland/riparian, to investigate how plants are able to surmount the challenges of each ecosystem.

Stephanie Mayer, PhD, is a Senior Instructor in the Department of Ecology and Evolutionary Biology at the University of Colorado Boulder, where she has been teaching upper-level classes on Plant Biodiversity and Evolution, Plant Anatomy and Development, and Plant Systematics for over 20 years. She received a PhD in Botany at the University of California Berkeley, followed by a postdoctoral fellowship at the University of Chicago. Stephanie has conducted research in plant systematics and breeding systems in the Hawaiian Islands and California.



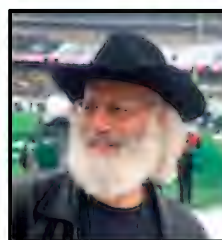
June 3, 9:00 AM - 11:00 AM **Practical Post-Fire Restoration Tips for Colorado Residents** **Presenter: John Giordanengo, MS, CERP**

This webinar will cover erosion control and revegetation tips, treatments, and considerations for landowners affected by the 2020

Colorado fires. Specific topics presented include:

- Revegetation strategies: The ins and outs of developing and ordering seed mixes. Seed mixes by elevation band in the East Troublesome Creek and Cameron Peak Burn area will be provided.
- Erosion control: Design and planning for gully stability, hillslope stability, and other erosion control needs. Post-fire erosion control treatments provided.
- Soil amendments and mulch: The driving factors for integrating mulch and soil amendments into a revegetation plan.
- Post-fire restoration studies: Case studies and research results following the 2012 High Park fire.

John Giordanengo's drive to continually improve the science and practice of ecological restoration grows out of a passion for conserving natural resources. Since 1996, he has provided a broad range of services to local, state, & federal agencies, and private clients to restore riparian, wetland, and upland habitats from the peaks to the prairies across Colorado, Wyoming, Washington, and California. This includes developing seed mixes and plant palettes, soil amendment & surface protection specs, bioengineering, erosion control, sourcing weed-free materials, and delivering restoration curricula. John has also worked collaboratively with multiple public & private entities to develop regional restoration planning efforts following fires and floods, including planning and regional prioritization of restoration projects. If there's one thing he has learned from 25 years of experience it's this: Every day provides a new learning opportunity in ecological restoration. We just have to keep our eyes (and ears) open.



June 19, 9:30 AM - 12:00 NOON **Gardening with Native Plants** **Series: Insect Pollinators of Colorado and Their Enhancement by Landscape Practices** **Presenter: Whitney Cranshaw, PhD**

A great many of Colorado's native plants require or benefit from insect pollination. Best known are various bees, which are extremely well represented in the state with over 900 native species. However, many Colorado plants have evolved relationships with moths, flies, butterflies and beetles. This will be a discussion that will first introduce the most important insect pollinators in the state, including how they develop and their association with plants. Later, landscape practices that can assist in the improvement of insect pollinator populations will be emphasized. This webinar is designed for audiences with both a beginner and more advanced understanding of Colorado pollinators.

Whitney Cranshaw, PhD, is an Emeritus Professor of Entomology at Colorado State University. For 37 years, he sustained an active program in the CSU Extension Service, teaching and researching on a wide variety of insect-related issues in the state, particularly related to insects of horticultural plants (fruits, vegetables, flowers, trees/shrubs). Conservation and enhancement of insects has long been a particular interest, beginning with his development of the first US University Extension programs on the subject of butterfly gardening (1985). He has authored hundreds of publications on subjects related to Colorado insects, many of which can be accessed at the Colorado Insect Information Website he continues to maintain. ☞

CoNPS Chapter Updates and Events

Boulder Chapter

The Boulder chapter steering committee recently learned of a developing botanic garden in Lyons. The Rocky Mountain Botanic Gardens (RMBG) is a native plant educational garden designed to teach visitors about plants from different ecological zones of Colorado and encourage the use of native plants in home gardening (<http://www.rmbg.org>). Dedicated volunteers create, plant, and maintain the gardens and host a Little Free Library for garden and nature books. The Boulder chapter hopes to offer a field trip to RMBG this summer. Donations of funds to support the coming planting season and books for the free library would be much appreciated.

Metro-Denver Chapter

In order to keep members engaged during what is likely to be an uncertain summer, the Metro-Denver Chapter will continue holding virtual monthly meetings on the second Tuesday of every month through Fall 2021, in addition to in-person field trips.

June 8, 6:30-8:30 PM, Jennifer Ackerfield, Head Curator of Natural History Collections with Denver Botanic Gardens, "Denver Eco-Flora Project"

July 13, 6:30-8:30PM, TBD

August 10, 6:30-8:30 PM, Chris Helzer, Director of Science in Nebraska with The Nature Conservancy and creator of The Prairie Ecologist Blog

San Luis Valley Chapter

We have a new CoNPS chapter! Carol English, Chapter President, has announced the formation of the San Luis chapter. This chapter will include the counties of Saguache, Alamosa, Rio Grande, Conejos, Costilla, and Mineral. Currently, there are over a dozen folks who are interested in participating and helping out with the chapter.

Field trips are already on the calendar. In addition, Carol plans to offer a few native plant classes this year just to get the plant ball rolling. For the future, she would like to expand offerings to include a Native Plant Master® program, gardening with native plants, classes and citizen science about native plants and pollinators, and botanical explorations in specific areas around the Valley.

Carol is intending to connect with local agencies such as USFS, Great Sand Dunes National Park, BLM, NRCS, Southwest Conservation CORPS, Orient Land Trust, TNC, and State Land Board for possible

volunteer opportunities. She will also offer programs via Zoom and other web options.

If you are interested or know folks that may be interested, please have them contact Carol English at slvchapterpresident@gmail.com.

Southeast Chapter

May 19, 6:00-7:30 PM, Curt Nimz, "Paint Mines Interpretive Park Slideshow"

May 29, 10:00 AM to 6:00 PM, Tom Green, Bioblitz Greenhorn Ranch

Help CoNPS Member Tom Green explore his new backyard! Tom acquired 175 acres of forested hills west of Rye in Sept 2020 and would love help identifying plants and advice on how to restore, protect and enhance the flora. Elevation ranges from 7600 to 8100 ft of lower montane forest with a perennial stream. Most of the land is wild with hazards typical of off-trail hiking such as downed trees and dense shrubs.

June 6, 8:00 AM to 12:00 NOON, City of Colorado Springs BioBlitz- Corral Bluffs

Come join the SE Chapter and the City of the Colorado Springs for the annual city BioBlitz. We will have the rare opportunity to enter city open space property. It is rich with cultural history and dryland species native to Colorado. Please register at: <https://cerv.is/m?0132gwHTXfn>

July 21, 8:00 AM to 12:00 NOON, Kathleen Marriage Historic Native Garden Installation

Volunteers of all ages and abilities are invited to join us to install and maintain this historic native garden in Sondermann Park. Projects will vary month to month.

Bring work gloves, sunscreen, sturdy shoes, water, snacks, and layered clothing for our ever-changing weather. Additional watering needed in between if you are available!

Contact: ecocitycoloradosprings@gmail.com

To learn more about Kathleen Marriage visit <https://hartley-botanic.co.uk/magazine/gardening-life-uk/>



CoNPS Field Trips

Due to COVID restrictions, registration will be limited to 8 people per field trip. Masks are required, social distancing is expected, and carpooling is discouraged. Please stay tuned for specific dates! Please go to the CoNPS event calendar for up-to-date information. <https://conps.org/mfm-event-calendar/#!calendar>

Boulder Chapter

May 25: Joder Ranch Trail with Pat Butler

June 5: Hightower Spring Ranch with Anna Theodorakos

June 8: Hike and Draw on Open Space Trails with Suzanne Michot

Metro-Denver Chapter

May 26: Geology, Ecology and Wildflowers Series—Part I; Green Mountain Hayden Park with Tom Zeiner

June 2: Geology, Ecology and Wildflowers Series—Part 2: Matthews-Winters Open Space Park with Tom Zeiner

June 11: North Table Mountain with Tom Schweich

June 13: North Table Mountain with Tom Schweich

June 15: Reynolds Park with Kelly Ambler

June 19: Golden Gate Canyon State Park with Judy King

Early July: Loveland Pass Lakes with Kelly Ambler

Mid July: Alderfer/Three Sisters Park with Anna Wilson

Mid July: Shrine Ridge/Vail Pass with Sue Janssen

Northern Chapter

May 21: Well Gulch Wildflower Walk with Maddie Maher

June 1: Moss Walk with Stacey Anderson

June 5: Hightower Spring Ranch with Ann Grant

June 15: Evening Plant Ramble, Pineridge Natural Area, Fort Collins.

June 26: Exploration of Red Mountain Open Space

San Luis Chapter

May 22: Beginning Botany Explorations - Liberty Road Area with Carol English

June 5: Beginning Botany Explorations - South Crestone Creek Trail with Carol English

Southeast Chapter

May 27: Paint Mines Interpretive Park with Curt Nimz

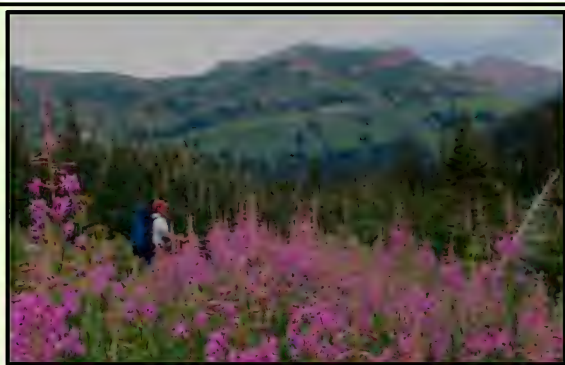
June 5: Florissant Fossil Beds National Park with Maggie Gaddis

June 13: Elk Park Hike for alpines on Pikes Peak

June 23: Emerald Valley Hike for Yellow Ladyslippers

July 10: Cottonwood Pass Hike for Continental Divide Alpines

Cross-Pollination Events



Hold the Date!

July 9-18, 2021

Crested Butte Wildflower Festival

<https://crestedbuttewildflowerfestival.org/>

Over 100 hikes and classes in the Wildflower Capital of Colorado!

May 15-22: Colorado Noxious Weed Awareness Week

May 15-31: Boulder "Get Growing" campaign
<https://bouldercolorado.gov/get-growing>

May 16-22: Colorado Endangered Species Week

May 21: Endangered Species Day
<https://www.endangered.org/campaigns/endangered-species-day/>

June 19-24: Society of Wetland Scientists Annual Meeting
<https://sws.org/Sample-Content/annual-meeting.html>

June 1-30: Great Outdoors Month

June 5: World Environment Day
<https://www.worldenvironmentday.global/>

June 25-27: Wyoming Native Plant Society Annual Meeting
<http://www.wynps.org/activities/2021-annual-meeting/>

June 24-27: Eriogonum Society Annual Meeting,
<http://www.eriogonum.org>

July 12-18: National Forest Week

***Herbarium: The Quest to Preserve & Classify the World's Plants*, by Barbara M. Thiers**

Reviewed by Suzanne Dingwell

"On the face of it, it's just a collection of dead plants," laughs Barbara Thiers in a recent podcast discussion on the topic of herbaria. In case you are wondering, an herbarium is a collection of dried plant specimens mounted on paper, labeled, and cataloged for archival and research purposes. It's also the name of a building that houses such a collection.

In her new book, *Herbarium: A Quest to Preserve & Classify the World's Plants*, Thiers has constructed a fascinating story about the creation of herbaria all over the world. The book gives brilliant proof that, far from being dead collections, herbaria are both very much alive and important.

Thiers first aspired to increase public interest in the subject at the New York Botanic Garden's William and Lynda Steere Herbarium, where she has worked for 40 years and now serves as director. She began by holding open houses, laying out tables of specimens, and having staff on hand to tell the stories of the individual plants and how each came to be placed in the herbarium. She found that people were very interested and kept asking, "Is there a book I can read about this?" When Timber Press approached her about writing one, she was ready and eager to take it on.

Thiers found that her biggest problem was not what to put in the book, but rather what to exclude. The same problem presented itself for this book reviewer as well. *Herbarium* overflows with so much of interest—history, mystery, scandal, and adventure abound. Even those familiar with the ongoing relationship between humans and plants will make new discoveries as Thiers leads them through centuries of plant explorations.

At the heart of those journeys is the truth that vital knowledge about plants and where they grow has always been worth seeking and preserving. As Thiers writes here, "As much as our modern lives tend to separate us from the rest of earth's biodiversity, we cannot exist without it, and these preserved organisms give us information about our world and clues to its future that we cannot learn any other way."

The book itself is definitely a thing to have and to hold, so do yourself a favor and invest in a hard copy. The abundant illustrations deserve special note, since they include reproductions of herbarium specimens, paintings, gorgeous hand-drawn and hand-painted plant renderings, maps, portraits, photographs of botanical gardens, and images of historical sites from around the world, all enhancing the lucidly written narrative.

Beginning with the first written records of plant knowledge in India and China, Thiers' book paints a

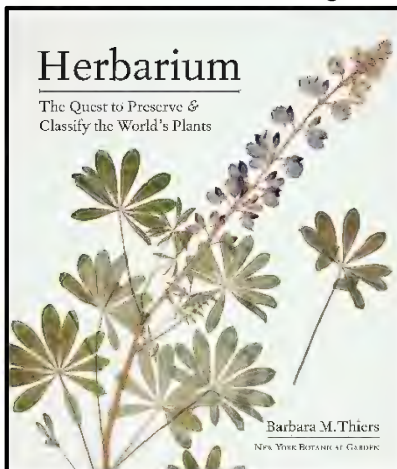
vivid picture of the evolution of humankind's search to find and understand the plants that inhabit our world. She introduces the reader to many of the "odd but lovable" wandering plant seekers who sought out such knowledge, and she vividly depicts their explorations and adventures.

For instance, the first known herbarium was created by Luca Ghini, a physician from Italy who loved plants. Hired by the University of Bologna to lecture in medicine in the early 1500s,

he began by teaching his students about medicinal uses of plants. Next, he brought plants into the classroom so that his students could observe living plants rather than simply read about them. Eventually, his class became so popular that a course on botany became a core part of the medical curriculum.

Seeking a way for students to study real plants during the winter months, Ghini began to press, dry, and preserve the plants, and the first herbarium was born. Ghini later created the world's first botanic garden in order to establish a living resource for his students. If you visit the Tower of Pisa, you can still see his garden in that neighborhood.

In the eighteenth and nineteenth centuries, European countries began sending out voyages of discovery, resulting in tales of adventure that are not only instructive to botanists and ecologists, but also highly entertaining. For example, Jeanne Baret, a French peasant with demonstrated knowledge of local medicinal plants, posed as a man in order to accompany naturalist Philibert Commerson—who ►



◀ also happened to be her lover—on the ship of a French expedition. Baret became the first woman to circumnavigate the world and was largely responsible for collecting the majority of the 30,000 plant specimens collected on that expedition, many still stored in numerous herbaria around the world.

José Mutis, sent by Spain to South America, not only collected plants, but was also committed to improving the lives of the people there. He trained locals to illustrate plants for the Casa de Botánica he established. They developed a distinctive technique using dyes derived from native vegetation to produce more vibrant colors than those being used in European illustrations at the time.

As the book shifts to the United States, we meet explorers and botanists we know from our own nation's history and whose names have become so familiar through the plants they discovered. Thomas Nuttall, John and William Bartram, John Clayton, Gotthilf Henry Muhlenberg, Asa Gray, and Lewis and Clark are among those featured. Thiers also relates the story of botanist Alice Eastwood, who ran into a burning building following the Great San Francisco Earthquake of 1906, intent on reaching the herbarium on the sixth floor. Upon seeing that the marble staircase had collapsed, Eastwood used the remaining bronze banister rungs to reach the herbarium and save as many specimens as possible for the California Academy of Sciences.

Thanks to these plant-loving people, Thiers reminds us, the world gained the first herbarium, the first botanical garden, and the first laws to protect native plants, among other unique achievements. The California Academy of Sciences became one of the first institutions in America, and quite possibly the world, to recognize and encourage women scientists, thanks to the accomplishments of Eastwood and her mentor, Mary Katherine Brandegee, who spent her honeymoon walking 500 miles from San Diego to San Francisco to collect plants with her equally plant-passionate husband.

Moving into more modern times, Thiers touches on contributions to plant discovery and herbaria from countries around the world, including China, Africa, Brazil, and Australia. I should mention, too, that those who appreciate algae, bryophytes, and fungi will find plenty of references and artwork pertaining to these nonvascular organisms as well.

The final section of the book explains the relevance of herbaria to the challenges of today. New and better tools, such as mapping and GIS systems, next-generation DNA sequencing, and powerful ways to organize data, give herbarium records new applications as we are able to study life on both molecular and global scales.

Thiers explains the uses of these records as we confront species extinction, invasive plants, pollution, and changes in atmospheric conditions and phenology. As climate change threatens and alters our world, understanding these changes will be important in decision making. Herbaria are here to help, and a more enjoyable and informative book about them would be hard to imagine.

Sue Dingwell started her native-plant journey in Florida, where the revelation of what plants could do in the hot sand scrub was a transformative learning experience. She became a member of the Florida Native Plant Society, and used her background in education to become a dedicated advocate for native plants and conservation. A Master Naturalist in both Florida and Virginia, Sue is currently a member of the both the Virginia and Colorado Native Plant Societies, and plans to live in Colorado full-time this spring.

Also see: https://nrmnh.typepad.com/the_plant_press/2021/05/the-botanical-pressed-specimen-sheet-an-artform-in-itself.html



This night blooming Colorado native, *Mentzelia decapetala* (10-petal blazing star) was first described by Thomas Nuttall, who made the mistake of showing it to Fredrick Pursh. Pursh published it in his next collection under his own name. Page 120 of *Herbarium*.

Meet the New *Aquilegia* Team



Kelly Ambler developed a budding interest in plants and landscapes as a child learning about gardening from her grandmother in New Mexico and traveling throughout the Four Corners backcountry with her family. She is trained as a biomedical research scientist and

earned her PhD in biology at the University of California, San Diego, where she enjoyed abundant opportunities to experience California coastal, mountain, and desert ecosystems in her spare time. She performed postdoctoral studies at the University of Chicago, which afforded her the opportunity to explore lakeshore, tallgrass prairie, and Northwoods ecosystems in the Upper Midwest. She is interested in all aspects of the natural world and loves hiking and backpacking in the diverse environments around Colorado and the Southwest. Her current fascination with Colorado's native plants started as a way to understand more about different ecosystems. Kelly has been a CoNPS member since 2012 and is certified as a Colorado Native Plant Master®. She has been the associate editor for design and layout of *Aquilegia* since Fall 2017. Kelly lives in Denver with her husband, Dale Brown, and their cats.



Nan H. Daniels, *Aquilegia* proofreader (since 2015) and occasional author, is a retired GIS analyst whose work brought her into the realm of rangeland health and wildland restoration in the early 2000s. Professional colleagues, her mother's

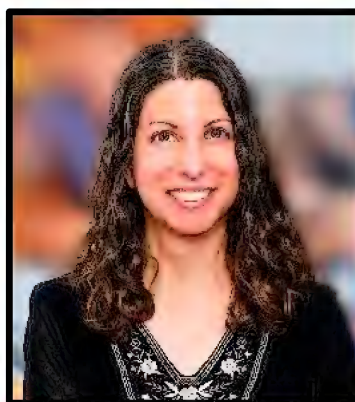
membership in the Native Plant Society of New Mexico, and volunteer work with Fort Collins Gardens on Spring Creek began to involve her in CoNPS. For the northern chapter of CoNPS, she's on the leadership team and monitors the Loveland Open Lands Advisory Commission; and she previously served as CoNPS board member. With partner Curt Cole, Nan was volunteer steward for a two-section Colorado Natural Area in Park County, 2007–2018. A

longtime gardener, she was happiest last year with the best bloom yet of *Penstemon grandiflorus* she started from seed. She continues with photography, hiking, quilting, and mask projects, and realizes now she's addicted to genealogy research.



Sue Dingwell first gardened her way through nine of the Eastern Seaboard states from Florida to New York and is now learning the Colorado natives. She became a Master Gardener in Florida and served the Cooperative Extension Service for ten years, introducing and teaching

a native plant component for their MG program. She is also a Master Naturalist in both Florida and Virginia, and served on the Board of the Native Plant Societies in both those states as well. With an English major and a Masters in Education, Sue relishes the chance to combine her love of language and native plants in assisting with the *Aquilegia*.



Alyse Greenberg has spent approximately 20 years working and volunteering for water and conservation organizations. She currently works as the content manager for a nonprofit water-research organization, serving as editor of their quarterly magazine and reviewing

and publishing research reports. Prior to moving to Colorado in 2012, Alyse coordinated the newsletter and PR efforts at Bowman's Hill Wildflower Preserve in Pennsylvania. The preserve is where she first developed a passion for native plants. While she still knows mostly East Coast plants, she has slowly been working on her Colorado plant-identification skills. Alyse has her B.A. in biological sciences from the University of Delaware and her certificate in marketing and communications from the Nonprofit Center at La Salle University. She is excited to be part of the *Aquilegia* team and to use her communications background to advance the mission of the Colorado Native Plant Society. ►



◀ **Jenifer Heath** is a toxicologist with more than 30 years' experience as a consultant related to environmental contamination and accidental exposure to toxins. (Yes, there are actually PhD programs in poisons!) She has zero background in botany, plant pathology,

horticulture, etc. Starting at age four, Jenifer has lived in Colorado four times (Pueblo, Boulder, and Denver), interspersed with moves to 12 non-Colorado homes. (She now plans to stay here for the rest of her life!) Perhaps eight years ago, Resource Central's Garden In A Box program lured Jenifer into the world of water-saving plantings to replace a thirsty lawn. Prior to this, she had done possibly no gardening of any kind, nor had any particular interest in plants. She killed some grass and planted a couple of RC's gardens. It was easy and successful! She quickly refocused on pollinators and later shifted to native plants with the intention of creating habitat. Jenifer feels she is still on a steep learning curve and keeps uncovering mistakes and trying to correct them. She is excited to work on *Aquilegia* to learn even more through this experience and share some of the enthusiasm that she now has for native plants!



Gayle Hemenway began to appreciate Colorado native plants in 2010, when a friend and bee expert helped her see that a green and flowery neighborhood park that looked great to humans was a virtual desert for wildlife. Within a few years, she had joined the Colorado Native Plant Society,

become a native plant activist, and created a Habitat Hero landscape that was featured on the first native plant garden tour in Fort Collins. Since becoming active with CoNPS, she has marveled at the depth of knowledge within the membership about native plants, botany, conservation, horticulture, ecosystems, environmental issues, and more, as well as the talent in photography, art, and writing (everything from detailed research reports to cartoons!). By joining the staff of *Aquilegia*, she looks forward to collaborating with fellow members while advocating for native plants and other quiet friends on this earth. Gayle graduated

from Colorado State University and has a background in journalism, publishing, law, and volunteer work.



Sue Keefer, originally from northern Illinois, has lived near Las Animas, CO, since 1987; prior to moving there, she lived in Grand County, CO. She has a bachelor's degree in journalism from the University of Missouri and a master's degree in library science from

Emporia State University. Her journalism experience includes working as a reporter/photographer and as an editor for daily and weekly newspapers in Illinois, Iowa, and Colorado. Sue's library experience includes bookmobile, school, public, prison, and academic libraries. She retired as library director at Otero Junior College in La Junta, CO, in 2017. Since retiring, she has been a volunteer for National Park Service/Amtrak Trails & Rails program; Colorado Parks and Wildlife (wildlife transporter and photographer); and the U.S. Forest Service Picket Wire Canyonlands tours. Sue has always enjoyed photography, but her interest intensified since retirement and especially during COVID. Although originally focused on wildlife photography, she has expanded her interest to native-plant photography as well, and enjoys taking macro photos of insects and plants. A couple of years ago, she heard of the CoNPS photography contest, entered, and won a prize. Since then, she's been active on the CoNPS Facebook page and has remained a member. Because of CoNPS, she has started a native-plant garden on her property. Sue is looking forward to working with the rest of the editorial staff on *Aquilegia* and hopes she can further expand her knowledge of native plants. Over the past year, she's enjoyed several CoNPS webinars and is extremely excited that the next conference is set for southern Colorado. She is planning to attend and looking forward to meeting other CoNPS members.



Lenore Mitchell is a Colorado native and has fond memories of riding horses in places now lost to development such as Highlands Ranch, Roxborough State Park, and many more. She has been active in CoNPS for many years and in many capacities, such as ►

◀ past president of the Metro-Denver chapter and a contributor to *Aquilegia* as an author, a photographer, a proofreader, and an editor. She was a master gardener for 10 years, has taught the Native Plant Master® course for CSU Extension for more than 14 years, and has presented courses for Osher Lifelong Learning Institute (OLLI) at Denver University and other programs. She enjoys the opportunities to keep learning more about Colorado's flora, "teaching is a great way to keep learning."



Alan Moores came to the world of horticulture well into his 40s, beginning in 1992 with a 300-square-foot community-garden plot procured through the Seattle Parks Department. He soon enrolled in the King County (WA) Master Gardener program, became co-coordinator of the children's vegetable garden at his son's elementary school, and

also became coordinator of his community garden, a position he held for some 15 years. Inspired by Douglas Tallamy's *Nature's Best Hope*, about returning all-important insect populations to their levels of some 30 or 40 years ago, he learned about the primacy of native plants to so much of the world of fauna. A professional editor for nearly 50 years – *Booklist*, *Seattle Times*, *Serendib*, and *Mandarin Oriental* magazine, among others – he's found that becoming a member of the Colorado Native Plant Society in 2020, and contributing to its quarterly publication, *Aquilegia*, is one way to make himself useful in that effort.



Patty Rhodes has been gardening in Colorado for 20 years. She quickly found that gardening in Colorado was going to take perseverance after almost guaranteed success in the southeast part of her home state of Virginia. She "dug right in" to learn about soil, climate, and what works and what doesn't. Her

gardens are bee-, butterfly-, and bird-friendly with plants native to Colorado. Last year she became a Colorado Master Gardener. She's excited to work with the *Aquilegia* team because "she loves learning about

plants, and there's always more to learn," and it gives her the opportunity to tap into her creativity.



Cathi Schramm has been on the proofreading team of *Aquilegia* for a little over two years. Her love of native plants goes way back, kindled during long walks in the forests and bogs of Cockburn Island in Lake Huron, and growing ever since. She has carried that passion from Michigan to Indiana

to Lakewood, Colorado, where she lives with her partner, two children, and front-lawn-turned-native-plant-garden. It's a labor of love and a work in progress, increasing in variety and biodiversity with every new season. She recently completed an M.A. in conservation biology, has begun NPM courses through the CSU Extension, and serves on the board of directors of PLAN Jeffco, advocating to preserve wildlands for generations to come. In her day job, she works as a technical writer and instructional designer, and is looking to shift her career in a direction that will use her skills to preserve and restore our imperiled ecosystems.



Linda Smith, a proofreader for *Aquilegia* for several years, has been the part-time administrative coordinator for the Colorado Native Plant Society since 2008, after retiring as administrative assistant with CSU Extension in El Paso County. During her time at Extension, she also taught plant ID to Master

Gardeners for 15 years, developed the publication, "Identification Key to Woody Plants of the Pikes Peak Region," and was an NPM instructor. Upon moving to Loveland, Linda volunteered with the Colorado Natural Areas Program and Denver Botanic Gardens in their stewardship programs. An avid conservationist, she is currently volunteering as co-chair of the CoNPS Conservation Committee. Linda's interests in photography and botanical illustration of native plants have led her to develop a coloring book of Colorado native plants for CoNPS to sell in the bookstore this summer, with a few pages for the website for folks to download individually. Linda currently is going through the archived issues of *Aquilegia* and finding historical data for our new website. *Aquilegia* has always ►

◀ been a treasure, from the very first issue until now. We have many fine editors to thank for that, and Linda is grateful to be a small part of the current team.



Elizabeth Taylor's father was a botany professor, but, much to his dismay, Elizabeth pursued education and a career in zoology, wildlife management, and technical communication instead of botany. It was not until she retired that she started following in his

footsteps and became a certified Colorado Native Plant Master® and an NPM instructor. This spring she will be co-teaching an NPM class with Heather Koch at Douglas County's Sandstone Ranch Open Space. In addition, you will find her leading wildflower hikes for Douglas Land Conservancy and Douglas County Open Space. Elizabeth also expresses her passion for land stewardship through volunteering as a naturalist for DLC and DCOS, coordinating the DLC/DCOS Bluebird Project, and serving on the DLC board of directors. If you visit her home, you will not find manicured gardens or well-tended plants. Instead, she and her husband Curt maintain their wooded acre as a National Wildlife Federation Certified Wildlife Habitat, where they enjoy bird-watching as well as observing deer consume any misguided attempts at growing flowers. Elizabeth likes to read about Colorado native plants and native-plant gardening in *Aquilegia* and vicariously enjoys the gardens of others.



John Vickery is an experienced land-stewardship practitioner, specializing in vegetation management. He conducts botanical surveys of protected areas in the northern Colorado Front Range. For CoNPS, he also helps out in the Conservation, Field Studies, and Education

and Outreach Committees. He has been a proofreader for *Aquilegia* for many years.

Ever since **Anna Wilson** was very young, she was fascinated with flowers. When Anna was a preschooler, her father would take her out in the backyard to key out plants; the name *Euonymus europaeus* flowed off her tongue; most of her



childhood art featured flowers and trees; and her favorite museum exhibit was the Glass Flowers at Harvard University. In college, it was rocks that caught Anna's attention (plus, there was no need to take biology with the pre-meds), which led to a 33-year career with the U.S. Geological Survey. But her geology field notes contain many

mentions of flowers, there are pressed specimens between the pages, and flowers are usually prominent in most of her rock photographs. Eight to 10 years ago, a couple of CoNPS field trips renewed her interest in flower identification and introduced Anna to local bibliographic sources. Since her retirement from the USGS three years ago, lots of flower hikes, more CoNPS field trips, volunteering on the plant team at Staunton State Park, and several NPM classes later, she can finally key something out if she is both desperate and lucky. Otherwise, IDs are based on memory and observations. Anna's daughter asked why she can't like a flower without knowing its name, but, to Anna, that would be like not knowing one's friends' names. She loves learning more about wildflowers in *Aquilegia* because the articles are mostly understandable to a nonbotanist, it is a vehicle to discover habitats that she rarely sees in her alpine-to montane-centric world, and the photos are inspiring. In winter, her passion (and profession) is skiing.

News in the Press

Plant Heist. A short documentary about fighting the illegal smuggling of a native succulent, *Dudleya farinose*, in California.

<https://mailchimp.com/presents/sxsw/plant-heist/>
<https://www.plantheistfilm.com/>

Maryland law prevents HOA's from banning native plants or from requiring lawns.

<https://www.humanegardener.com/butterflies-1-hoa-bullies-0/>

Nine groups joined in urging then-elect-President Biden to update and expand plant conservation programs. <http://ymlp.com/ztFWIN>

In March, *The Plant Press* honored women botanists by highlighting the achievements of several women who worked at the US National Herbarium. https://nrmnh.typepad.com/the_plant_press/2021/03/notable-women-in-science-women-of-the-united-states-national-herbarium.html

Blast from the Past

Growing a Colorado Native Shrub, Kinnikinnick or Bearberry (*Arctostaphylos uva-ursi*)

By Gail Evans and Kim Vories

Kinnikinnick is a low, evergreen, prostrate shrub with tiny, leathery leaves. The leaves are reddish when young, glossy dark green when mature, and bronze in the Fall. The branches tend to root wherever they touch the ground. Kinnikinnick forms a low mat from 6-12 inches high and spreads slowly. The flowers bloom from April to June, depending on the plant's location. The tiny, waxy, pink to white urn-shaped flowers are disposed in a short, few-flowered raceme. The fruit is a berry with 4-10 hard seeds. The berries are about $\sim\frac{1}{4}$ inch in diameter and red when mature. The seeds are presumably dispersed by birds and mammals which eat the fruits. The number of seeds per pound ranges between 26,800 and 58,000. Seeds may mature from June through early Fall. Fruits may be collected by hand or picked off the ground but only after they are fully mature. Seed can be separated from the pulp by maceration in water, followed either by flotation (the seeds sink) or by fanning when dry.

Seed can be stored for 1 year in dry, air-tight containers, followed by stratification and planting the following year. The seeds have very hard coats and germinate erratically, even with pretreatment. Several methods may be used to help break dormancy. For field planting it is best to soak the seed in concentrated sulfuric acid for 2-5 hours. CAUTION: concentrated sulfuric acid is dangerous and should be judiciously used. Wash all containers and seeds in water after treatment and keep acid away from skin. For stratification following the acid treatment: (1) warm stratify at 25° C for 60-120 days followed by (2) moist stratification at 3-5° for 60-90 days. Seed can be stratified in a medium of sand, peat, or a mixture of peat, loam, and perlite. The type of stratification may

have an effect on the biological activity within the seeds particularly during warm stratification.

Both softwood and hardwood cuttings will root somewhat easily, and many nurseries prefer this type of propagation over seed germination for Kinnikinnick. A high degree of hybridization with other species of *Arctostaphylos*, largely on the western slope of Colorado, allows the selection of certain desirable horticultural forms only by this type of propagation. Kinnikinnick survives well in direct sun and dry soils, as well as on moist, shaded sites. It grows best where the soil is coarse and sandy or rocky, well-drained, and slightly acid. Avoid planting this shrub on heavy, clay or alkaline soils.

Kinnikinnick has had many uses. Berries were used by pioneers to make ciders and jellies.

Indians used parts of the plant for medicinal purposes, teas, and a type of tobacco. Extracts of the leaves have been used to cure leather and as a lotion for ameliorating the effect of poison oak or sumac.

The information contained within this article has been extracted from several articles and the personal experiences of the authors. More detailed information may be obtained from Kim Vories, Range Science Dept., CSU 80523.

Editor's note: the paragraph on local seed sources has been left out, since the businesses are no longer active.

Reprinted from the *Colorado Native Plant Society Newsletter*. 1978. Vol 2.6:3.



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DUES include the electronic version of the *Aquilegia* newsletter, published quarterly.

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The Colorado Native Plant Society is seeking an Executive Director

The Colorado Native Plant Society is a Colorado 501(c)(3) Corporation whose mission is furthering the knowledge, appreciation and conservation of native plants and habitats of Colorado through education, stewardship, and advocacy. It is managed primarily for and by member volunteers to provide activities which engage, educate, stimulate, and create a positive experience for its members. Please see the following document for the position description, compensation, and application process (<https://conps.org/wp-content/uploads/2021/04/Ad-for-Executive-Director-CoNPS-Final-Ver-2-1.pdf>)

To apply, send your resume or cv and cover letter via email to conpsoffice@gmail.com

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Thank you for your support and for the native plant stock that you provide!



Can You ID These Spring Flowers?

By Marlene Borneman



Answers (clockwise, from upper left): Nuttall's violet (*Viola nuttallii*, Violaceae family), Britton's skullcap (*Scutellaria brittonii*, Lamiales family), salt-and-pepper (*Lomatium orientale*, Apiaceae family), wavyleaf dandelion (*Nothocalais cuspidata*, Asteraceae family), cutleaf daisy (*Erigeron compositus*, Asteraceae family), Nuttall's oxypetal (*Oxytropis multiceps*, Fabaceae family). © Marlene Borneman

Colorado Native Plant Society



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2021 CoNPS Native Plant Sale

PICKUP HAS MOVED TO JUNE 26!

Pick-up locations can be found on the website <https://conps.org/2021-spring-plant-sale/#!form/2021SpringPlantSale>

There are some species available now which were previously sold out! Twenty-four species are now available. Order through June 23 while supplies last.

Volunteers still needed. Contact Denise Wilson, deniseclairewilson@gmail.com or call 303-642-0510.

2021 CoNPS Annual Conference, September 10-12

The Short Grass Prairie and a Long Look Back

Currently, we are planning an in-person event as well as a virtual option. However, the details of the in-person conference, including the number of attendees permitted, may change at any time depending on COVID restrictions in Las Animas County. We will do our best to adapt as needed and inform members as quickly as possible.

We will be looking at native plants through the lens of history and with an eye to the future. The Santa Fe trail ran right through Trinidad, where the conference is being held this year. Speakers will examine our connections with the past and how the plants sustained the existence of the first people who lived there, as well as the explorers and traders who came later. Ranchers, ecologists, and historians will be talking about how our knowledge of the past is informing our choices for the future. Field trips include Fishers Peak and a nature journaling trip, among others. The Rare Plant Symposium will take place Friday, conference speakers will be featured Saturday, and field trips are planned for Sunday.

We encourage those who intend to camp to book a campsite at your earliest convenience, since sites WILL fill up well in advance. Colorado State Parks allows you to book at Trinidad Lake State Park Campground now: <https://cpw.state.co.us/placestogo/parks/TrinidadLake/Pages/Camping.aspx>

We will also have a block of rooms at a discount at La Quinta Inn until August 20. Call 719-845-0102 and ask for Yvette, and tell her you are with the Colorado Native Plant Society. Reservations may be held by credit card and cancelled until three weeks before arrival.

Photograph © Lauryn Wachs/The Nature Conservancy